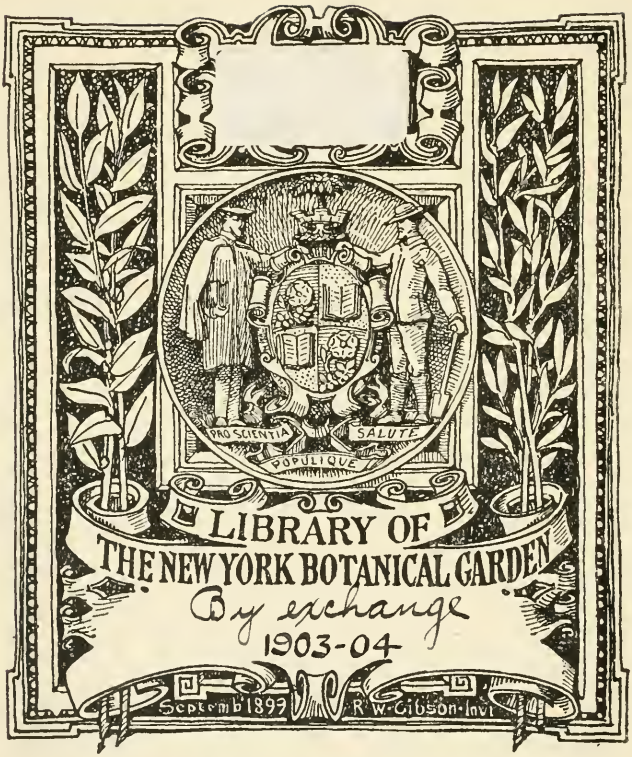
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TWO YEARS' FIELD WORK OF THE CHEMICAL BRANCH.

By F. J. Howell, Ph. D.

(A paper read before the Shepparton Conference, July 1902.)

PART 1.—THE NORTHERN AREAS.

The primary object of the farmer, put in a few words, is to increase the productive value of his land; to produce large and profitable crops while preserving, and even increasing the fertility of the soil that yields them. Till chemistry came to his aid the efforts of the farmer in this direction rested on pure empiricism. It is true he had discovered certain facts of importance before ever this science came to assist him; but these facts were stumbled on accidentally—were the results only of chance tests. With Liebig a new system was introduced, and the great German built upon the foundations of chemistry the scientific agriculture that is revolutionising the farming methods of to-day. To no branch of science does agriculture owe such a deep debt of gratitude as it does to the science of chemistry. The various ways in which the investigations of chemistry have founded, and are intimately bound up with the very existence of the great agricultural industries, would form a subject too wide for one lecture, or for a dozen lectures. I shall make no attempt this afternoon to show how this is so. I am going to treat only of the work of the chemist in connection with the practical operations of the farm; of the investigations of my branch in the field, carried out to assist the primary object of the farmer in increasing to its full extent the productive power of his land; of experiments conducted to determine soil deficiencies, the effect of various fertilizers intended to replace them; methods of application, systems of soil treatment, and the profits that can be shown to follow all such operations. These are all points which will be at once recognised as of great practical importance to the farmer.

The Work of Two Years.

I am going to treat of the work of the last two years only, because of my association with this work during that period, and because the larger and more important developments in field work have taken place within that time. But these larger developments were preceded by long years of pioneer work; of arduous, earnest efforts that met with little support and less sympathy. It was another blazed the path for the success of the operations of the two last years, and the State of Victoria owes a deep debt of gratitude to its late agricultural chemist, Mr. A. N. Pearson, for the first initiation of a truly scientific system of agricultural field experiments. For this we have undoubledly to thank Mr. Pearson.

The Commencement of Field Work.

In a masterly contribution on "Field Manure Experiments in Victoria," not yet out of the Government Printer's hands, Mr. Pearson gives the history of the movement in this State. From that publication I glean that the first suggestions for the establishment of experimental fields were made to the Minister for Agriculture by the chemical branch in 1886. The suggestion received the sanction of the Minister, but little or no support from the agricultural societies, and it remained for an officer of the Lands Department to secure the names of sixteen farmers who expressed their readiness to experiment on various crops. Out of the sixteen fields, six, it was stated, showed decisive results. A crop of sorghum at Dandenong was raised on one of the plots from one-third of a ton to 16 tons, and the pea crop from $1\frac{3}{4}$ bushels to $30\frac{1}{3}$ bushels per acre. Remarkable increases were shown in a barley crop at Mooroopna, a wheat crop at Parwan, an oat and maize crop at Berwick, and a hay crop at Balaclava. As a result of these experiments, the pamphlet, "The Farmer's Guide to Manuring," was written, and published by order of the Honorable J. L. Dow, then Minister for Agriculture. Between this date and 1898 there were a number of successful experimental fields established, principally in the southern districts. With two exceptions, however, I find no records of successful experiments in wheat-manuring in the northern districts. The manurial dressings advocated up to 1897 or 1898 were heavy, costing £1 to £3 an acre. It was probably this fact that prevented a larger support being given to the idea. As far as I am aware, it was the favourable results obtained by a South Australian farmer using much smaller quantities that led to a reduction in such dressings, while the light applications at present general in Victoria, and which might, I think, be claimed as the special introduction of our chemical branch, were suggested also by the action of a Victorian farmer, which I shall refer to later on.

My Appointment to the Chemical Branch.

When I commenced my lectures in the year 1899 throughout Victoria, I found that the feeling of the average farmer was not one of sympathy for the work I had taken up. The idea seemed ridiculous to the majority that science could come down and enter into a friendly partnership with the man at the plough, and that the much laughed-at expert and the stiff-necked cultivator could exchange friendly ideas; that they could afterwards leave with a mutual respect one for the other; with a compact between the two for a strong co-operative effort to put questions to the soil and to get answers. But the thing happened, and the experimental field became a thing of interest from one end of Victoria to the other. There were 270 such fields put down in the year 1900. The initial difficulties of a new movement of such magnitude were many. Officers had to be rapidly trained to the work in all its branches. Delays on farms were frequent, and the newness of the thing caused it still to be regarded by some with more curiosity than interest, and, in cases, with a leavening of

quiet ridicule. But three months after the ridicule had gone, and the truth of a new fact stood out in the long green strips, stretching 12 chains down the various paddocks from one end of the wheat-growing area to the other. Five months after this, the plots had given their returns to the stripper, and in the words of a clever Wimmera journalist, had shown us how to add another province to Victoria.

It is no wonder the results created astonishment, for they appeared just as remarkable to the chemist as they did to the farmer. It is something approaching the marvellous that 10 and 20lbs. of a black powder spread over an acre can produce such differences, and that for an outlay of a little over 2s. per acre, profits of 12s. and 15s. might be obtained. Returns from 85 such wheat fields were sent in from the first year's tests. The results were of the highest interest.

An Explanation of the Principles of Manuring.

Before criticising the figures, however, it will be better if I explain to you in a few words the principles of manuring. In nearly every case we apply a manure, farmyard or artificial, because it contains something required for the growth of the crop that is not naturally present in sufficient quantities in the ground. Now our plants take from the ground very many different substances, and the absence or shortage of any one of these in the ground acts injuriously on the growth of the plant. Fortunately, it is only three or four of these substances that do run out in the ground. All the manures that we apply are given because they contain either one, two, three or four of these important substances. The important substances in manuring are nitrogen, phosphoric acid, potash, and lime. We do not give these substances pure to our soils for various reasons, but in chemical combination with other substances, and these combinations form our manures. To understand manuring, then, you must know what substances are contained in the different manures you use. We find them in the following table :—

Phosphoric Acid is contained in—
Superphosphate, Thomas Phosphate (Star Phosphate), Bonedust, Guano.

Nitrogen is contained in—
Sulphate of Ammonia, Nitrate of Soda, Dried Blood.

Potash is contained in—
Potash Chloride, Potash Sulphate, Kainit, Ashes.

The question, then, in our experimental fields that we had to solve was the ingredient, or the number of ingredients, our soils were deficient in, and the best form in which we might give back this ingredient, for, as the tables show, we can give each of these ingredients in different forms. We can, for instance, give the phosphoric acid in the four forms of superphosphate, Thomas phosphate, bonedust and guano. We can give nitrogen in three forms, and potash in four forms. Remembering this, we shall easily find what the average returns of the 85 fields mean.

TABLE A.—RESULTS OF EXPERIMENTAL PLOTS ("A" SETS) IN THE NORTHERN WHEAT DISTRICTS, 1900–1.

AVERAGES OF 85 FIELDS.

Number of Plot	1	2	3	4	5	6	7	8	9	10	11	12
Manure given per acre ..	10 lbs. Concentrated Superphosphate	No Manure.	20 lbs Concentrated Superphosphate	30 lbs. Concentrated Superphosphate	No Manure.	50 lbs. Ordinary Superphosphate	56 lbs. Thomas Phosphate	No Manure.	50 lbs. Bonedust.	Same as 1 with 36 lbs Sulphate of Ammonia	No Manure.	Same as 3 with 72 lbs. Sulphate of Ammonia.
Cost of manure, per acre in, 1900	1/1½	..	2/3	3/4½	..	2/3	2/3	..	2/3	..	..	..
Serviceton to Nhill district ..	12·73	8·88	14·95	16·45	8·89	14·80	13·40	9·03	11·54	13·12	9·11	14·92
(Averages of 16 fields)	3·85		6·07	7·57	..	5·86	4·41	..	2·48	4·04	..	5·81
Jeparit to Dimboola district ..	12·44	9·75	14·21	15·22	10·08	14·81	12·74	9·99	10·34	20·95	9·91	15·20
(Averages of 9 fields)	2·69	..	4·35	5·25	.	4·76	2·72	..	·38	3·01	..	5·29
Longerenong Agricultural College Farm (1 field)	26·92	25·67	30·08	28·08	25·83	27·50	30·00	27·75	27 91	28·92	28·08	30·42
	1·25	..	4·36	2·31	..	1·03	1·89	..	·05	·95	..	2·34
Beulah to Lubeck district ..	17·43	14·31	18·87	19·72	13·90	18·97	17·64	14·88	15·98	17·95	14·58	19·22
(Averages of 19 fields)	3·12	..	4·73	5·69	..	4·74	3·08	..	1·20	3·27	..	4·64
Donald to Boort district ..	18·29	15·85	19·62	19·68	15·18	19·04	17·27	15·04	15·74	17·46	15·11	18·67
(Averages of 11 fields)	2·35	..	4·00	4·28	..	3·91	2·18	..	·68	2·38	..	3·56
St. Arnaud district	16·17	11·99	17·99	18·82	12·22	19·20	18·89	12·83	14·61	18·51	13·19	18·79
(Averages of 4 fields)	4·18	..	5·92	6·68	..	6·78	6·26	..	1·66	5·44	..	5·60
Lake Boga to Swan Hill district	13·12	11·22	13·43	14·62	10·56	13·55	13·49	10·93	11·91	12·48	10·33	12·77
(Averages of 5 fields)	1·90	..	2·43	3·84	..	2·87	2·69	..	1·21	1·98	..	2·44
Maryborough district	15·74	13·44	17·64	18·58	12·64	16·53	16·57	14.31	15·92	13·88	12·98	15·17
(Averages of 4 fields)	2·30	..	4·47	5·67	..	3·33	2·81	..	2·05	·45	..	2·19
Elmore to Kyabram district ..	13·73	10·72	15·32	16·69	10·72	16·27	14·79	10·07	13 35	13·88	10·80	13·10
(Averages of 5 fields)	3·01	..	4·60	5·97	..	5·76	4·50	..	3·03	3·34	..	4·30
Tatura district	17·37	15·57	18·98	19·98	16·48	19·10	18·51	16·48	17·86	18·22	16·93	18·27
(Averages of 5 fields)	1·80	..	3·11	3·81	..	2·62	2·03	..	·83	1·44	..	1·34
Nathalia to Cobram district ..	11·11	10·23	11·17	11·84	10·24	11·59	11·45	9·97	10·43	10·83	10·31	11·14
(Averages of 6 fields)	·88	..	·94	1·60	..	1·44	1·39	..	·35	·64	..	·83
Averages of 85 fields	15·18	12·38	16·71	17·61	12·24	16·75	15·64	12·55	13·91	15·30	12·52	16·57
	2·80	..	4·38	5·32	..	4·40	3·19	..	1·37	2·77	..	4·05

The first line of figures gives the actual yield of wheat from each plot, reckoned in bushels and hundreths of a bushel per acre, and the second line represents the gain due to the manure.

It will be seen that there were twelve plots in each of the 85 fields—eight manured, and four unmanured to serve as checks. The manured plots were 1, 3, 4, 6, 7, 9, 10, 12. On the first six manured plots manures containing phosphoric acid only, but in different forms, were used. Thus in the first three plots it was given in the form of a concentrated superphosphate, the next ordinary, the next Thomas, and the next bonedust. In the remaining two manured plots Nos. 10 and 12, a combination of phosphoric acid and nitrogen was used, the idea being to see if the soil further responded by an addition of the nitrogen to the phosphoric acid. No tests were made that year with potash, as many analyses had given reason to think that the northern soils were sufficiently rich in that ingredient. The facts that came out in these experiments were of high practical value to the northern wheat-growers and of great significance to the whole State. It was of importance to show to the country that, in a year of an average wheat yield of 8·84 bushels only, it was possible to double that average, based on results obtained from every part of the wheat-growing area; to prove that by the use of the drill, the application of manure, the adoption of the fallow, and the careful preparation of the seed bed, the farmer might be enabled to raise the yield of the colony from 8·84 bushels to one of 17·68. It was of value to find that the great soil deficiency throughout the North appeared, as far as the wheat crop was concerned, to be that of phosphoric acid, and that an addition of nitrogen gave no further increase. These results were distributed widely throughout Victoria, and created unusual interest. Applications poured in from all parts, and the difficulty was to restrain, rather than encourage, the desire for taking up experimental fields. Including the beet and wheat variety fields, the applications last year exceeded 400. The greater number of these applications received favorable consideration, for it seemed necessary to confirm the results of the former year by a repetition of similar tests, and to widen the scope of experiments so as to secure answers to problems in connection with manuring that had not been attempted in the first tests. There was the question of potash manuring, for instance, to be decided; of nitrogen applied in different forms, and in different ways; of the application of lime and gypsum; of the comparative effect of an application of a superphosphate in the drill, as a top dressing, and ploughed in; of the spring cultivation of the growing crop; and other points. All these points were considered in the tests of the following year. Many of the operations for determining the result of such tests had, however, to be left in the hands of the farmer, and in many cases there are not sufficient guarantees that these were properly carried out. As a result of the second year's experiments on wheat-manuring in the north of Victoria, I can now draw your attention to the average of 94 fields. The fields, as you see, are representative of an enormous area of country, and practically embrace the whole of our northern wheat-growing area.

TABLE B.—RESULTS OF EXPERIMENTAL PLOTS ("A" SETS) IN THE NORTHERN WHEAT DISTRICTS, 1901-2.

AVERAGES FOR 94 FIELDS.

Number of Plot	1	2	3	4	5	6	7	8	9	10	11	12
Manure given per acre	11 lbs. Concentrated Superphosphate	No Manure	22 lbs. Concentrated Superphosphate	33 lbs. Concentrated Superphosphate	No Manure.	51 lbs. good ordinary Superphosphate	54 lbs. Thomas Phosphate	No Manure.	46 lbs. Bonedust.	51 lbs. good ordinary Superphosphate and 48 lbs. Sulphate of Ammonia	No Manure.	51 lbs. good ordinary Superphoshate and 87½ lbs. dried blood.
	YIELDS IN BUSHELS.											
Cost of Manure, per acre, in 1901	1/4	..	2/8	4/-	..	2/2	2/2	..	2/0½	7/11½	..	7/0½
Lillimur to Nhill	12·17	7·97	14·28	15·58	7·93	14·21	11·86	8·05	9·24	14·18	8·06	14·33
(Averages of 18 fields)	4·20	..	6·31	7·65	..	6·28	3·81	..	1·17	6·12	..	6·27
Jeparit to Dimboola	11·53	8·08	14·95	15·87	7·87	13·03	11·87	8·37	9·41	14·17	7·82	13·31
(Averages of 4 fields)	3·45	..	6·87	8·00	..	5·16	3·49	..	1·04	6·34	..	5·48
Horsham	15·29	10.68	16·68	18·29	12·12	18·43	16·19	13·04	14·19	16·84	12·04	17·08
(Averages of 4 fields)	4·61	..	6·00	6·17	..	6·31	3·15	..	1·15	4·80	..	5·04
Warracknabeal to Murtoa	12·94	9·54	14·43	15·70	9·58	14·97	12·53	10·29	10·66	15·60	10·18	16·15
(Averages of 12 fields)	3·40	..	4·89	6·11	..	5·39	2·24	..	·37	5·42	..	5·97
Boort to Charlton	8·35	6·84	9·13	9·22	5·93	9·00	7·96	6·68	6·79	9·33	6·39	9·43
(Averages of 11 fields)	1·51	..	2·29	3·29	..	3·07	1·28	..	·11	2·94	..	3·04
Birchip to St. Arnaud	14·52	10·72	16·36	17·74	11·02	16·22	14·01	10·80	11·70	15·92	10·36	16·01
(Averages of 10 fields)	3·80	..	5·64	6·72	..	5·20	3·21	..	·90	5·56	..	5·65
Stawell to Ararat	16·16	12·33	19·49	20·66	13·58	20·91	18·58	13·16	15·50	19·50	12·41	20·74
(Averages of 2 fields)	3·83	..	7·16	7·08	..	7·33	5·42	..	2·34	7·09	..	8·33
Bendigo to Maryborough	17·14	13·63	18·81	19·43	12·66	17·37	16·74	12·07	14·86	16·69	12·76	18·91
(Averages of 7 fields)	3·51	..	5·18	6·77	..	4·71	4·66	..	2·79	3·92	..	6·14
Tatura to Shepparton	15·33	13·63	17·62	17·95	12·68	17·87	16·63	13·22	14·45	17·85	12·38	19·66
(Averages of 10 fields)	2·70	..	3·99	5·27	..	5·19	3·41	..	1·23	5·47	..	7·28
Cobram to Nathalia	10·82	10·46	12·49	13·68	11·10	13·04	12·40	11·39	11·25	12·30	10·44	12·70
(Averages of 5 fields)	·36	..	2·03	2·57	..	1·94	1·01	..	·14 loss	1·86	..	2·26
Yarrawonga to Rutherglen	16·24	13·16	18·57	18·69	13·24	17·85	18·10	13·49	15·52	18·60	12·08	18·13
(Averages of 6 fields)	3·08	..	5·41	5·45	..	4·61	4·61	..	2·03	6·52	..	6·05
Elmore to Echuca	11·49	8·14	13·57	15·04	7·81	12·89	11·98	8·09	9·64	13·29	8·46	14·12
(Averages of 5 fields)	3·35	..	5·43	7·23	..	5·08	3·89	..	1·55	4·83	..	5·66
Averages of 94 fields	13.58	10·43	15·53	16·49	10·46	15·48	14·07	10.72	11·93	15·35	10·28	15·88
	3.15	..	5·10	6·03	..	5·02	3·35	..	1·21	5·07	..	5·60

The first line of figures gives the actual yields in bushels, the second line the increases due to manures.

A Study of the Tables.

The results of these tables are particularly gratifying to me. Besides confirming, in almost every particular, the returns of the former year, they have widened our field of information, and given us a crop of new facts of great practical value. In a year marked by such a low general average, it is refreshing to turn to results showing so great an improvement. The manures used up to Plot 10 are the same in kind as the preceding year. They differ very slightly, however, in the quantity used. In Plot 12, nitrogen, instead of being given in the form of sulphate of ammonia, as it was in the preceding year, has been given in the slower acting form of dried blood. A comparison of the yields of the various plots for the two years will show that the figures of the first year are slightly higher than in the second. In the increase due to manures, however, the last year's results show an advantage. A comparison of the returns of Plots 10 and 12, where nitrogen and phosphoric acid have been applied, with those of Plot 6, where phosphoric acid only has been given, will show that in Plots 10 and 6 the increased yields are practically the same—a confirmation of last year's experiments, while in Plot 12 the yield is higher by half-a-bushel than in Plot 6, a result which might lead us to infer that nitrogen in the slower acting form of dried blood had shown itself effective. But dried blood also contains a small percentage of phosphoric acid, enough probably, in the 87½ lbs. applied on this plot to produce, at any rate, half the additional increase shown on the plot, and part of the increase, at any rate, can be attributed to that cause. The cost of the dressing on Plot 12 is, comparatively speaking, a heavy one—7s. 0½d. per acre—and the small increase produced by the blood would not justify such an expenditure. There is little doubt, looking at the average increases of the 94 fields, of the dominant influence of the action of phoshoric acid in the form of the superphosphate; 22 lbs. of concentrated in Plot 3, costing 2s. 8d. per acre, has given an increase of 5·10 bushels; 51 lbs. of ordinary superphosphate, containing the same amount of phosphoric acid, but costing only 2s. 2d., gives practically the same increase, 5·02 bushels—a most beautiful illustration of careful regular working. 54 pounds of Thomas phosphate, however, also containing the same amount of phosphoric acid, and costing the same money, results in an increase of 3·35 bushels only; and 46 lbs. of bone dust, costing 2s. 0½d. and containing the same amount of phosphoric acid, gives only an increase of 1·21 bushels. After such results obtained by two years' tests over such a wide area, the fact of the great hunger of the soils in that area for phosphoric acid is made strikingly clear. The figures also make clear that the superphosphate is the most suitable form in which to apply that element, and that the matter of nitrogen manuring requires, for the present at any rate, no consideration.

The Requirements of the Northern Soils in Potash.

But there was still the possible necessity of potash and lime in our northern soils to be considered. In the first year's experiments no

trials were made to test the deficiency of the soils generally in these ingredients. In last year's fields, however, the question received attention, and the results obtained are an addition to our knowledge. In the matter of potash 18 plots were put down in as many different districts. The plots in each case were manured as follow :—

Plot 1.—51 lbs. ordinary super.
Plot 2.—51 lbs. ordinary super. ; 48 lbs. sulphate of ammonia.
Plot 3.—51 lbs. ordinary super. ; 48 lbs. sulphate of ammonia ; 28 lbs. potash chloride.

Average increased yield per acre of 18 fields in bushels—

Plot 1.—5·35.
Plot 2.—5·30.
Plot 3.—5·53.

In No. 1 plot we have used phosphoric acid only ; in No. 2 plot phosphoric acid and nitrogen, and in No. 3 plot phosphoric acid, nitrogen, and potash, but the increased yield in plot 3 where the costly complete manure has been used is only approximately one-fifth of a bushel more than where the supherphosphate only has been applied. The soils then in the northern areas, taking the general average yields as a standard, are not in any appreciable want of potash, their one great hunger so far appears to be phosphoric acid only. There were, undoubtedly, plots among the eighteen that did appear to have been much benefited by the additional potash, but this might have been due to irregularities which have disappeared in the general average.

The Effect of an Application of Lime.

There was still the necessity for lime to be considered, and the solution of the problem was attempted in two ways by the application of lime alone, and by the application of lime in the form of gypsum in conjunction with the superphosphate. The direct application of lime drilled in with seed, at the rate of 1 cwt. to the acre, resulted in a material gain in thirteen out of the nineteen fields where it was tried, but in most cases the gain was not sufficiently great to cover the expenditure. The average increase of nineteen fields was ·97 bushels. The average increased yield on the thirteen fields referred to was 1·42 bushels. In the case of gypsum there were results only from ten fields obtained. The average increased yields were as follow :—Where superphosphate only had been used, 4·15 bushels ; where superphosphate with 56 lbs. of gypsum was applied, 4·22 bushels, an increase in favour of gypsum not worth considering. This is somewhat contradictory, for we might expect a result from gypsum somewhat proportionate to that from lime. The number of fields, however, was not sufficiently large to thoroughly test the matter, and in this year's experiments I have considerably increased the number. In districts where indications point to the possibility of gypsum showing effects, no returns, unfortunately, are available.

Other Questions than Soil Deficiencies.

So far we have treated merely of soil deficiencies and the manures most suitably replacing them. But there are questions in connection

with the application of manures themselves of almost equal importance. There is the time of application, the method of distribution, and the quantity to apply under given climatic conditions—questions which open up fields for investigation, as full of interest and practical importance as the questions just dealt with. Tests on all these points were attempted. That full answers have not been obtained, is the fault of the farmer and not the branch. One of the most interesting of these tests was the application of the superphosphate in various ways. An application with the drill was compared with a surface application ploughed in, in one case—in the other the application with the drill was compared with a like quantity given as a top dressing after the crop had come up. In the ploughing in test there were the results of five fields available for comparison. The returns showed, taking the average of the five fields, a slight gain in favour of ploughing in. Four fields showed in favour of ploughing in—one decidedly in favour of the application by the drill. This has influenced the average results, for an average of the four fields shows a gain in favour of the ploughing in of ·53 bushels. The results of such a small number of fields do not warrant one in speaking too decidedly in favour of the latter method of application, but the figures are certainly enough to suggest the thought that a deeper application of our manures, and the encouragement it would give to root development at a greater depth from the surface, removed from the effect of long dry spells—might exert a powerful influence on the welfare of our crops—at critical periods of the year.

Experiments, as already stated, were also carried out to test the advantage, if any, of an application of a superphosphate at the time of sowing the grain, over an application as a top dressing after the crop had come up. The results were so irregular as to indicate that the farmer in many cases had omitted the after application entirely. The same tests were to be carried out with the sulphate of ammonia. There are fewer irregularities in these returns, and the results in this case indicate a very slight increase in favour of the drill application at the time of sowing.

Horse-hoeing the Growing Crop.

In addition to the manure experiments, plots were included on the fields of several of the farms for tests in the cultivation of horse-hoeing of the crop in the spring of the year. In only one case was information received at the laboratory that the test had been carried out as requested, and Mr. Mackay of the St. Arnaud district wrote enthusiastically of the success of the operation. The returns were as follow :—

Increases Due to Manuring and Horse-hoeing.

Plot 1.—51 lbs. superphosphate, but not horse-hoed, 5·50 bushels.

Plot 2.—51 lbs. superphosphate and horse-hoed, 8·0 bushels. Increase due to horse-hoeing, 2·50 bushels.

Plot 3.—No manure, but horse-hoed, 2·83 bushels. Increase due to horse-hoeing, 2·83 bushels.

In both cases it will be seen the operation resulted in a substantial gain. It is possible that this one little result may be the beginning of great future changes in the treatment of the growing crop. Everything points to the probability of the loose earth mulch effecting the conservation of moisture in the undersoils of our fields under crop just as it does in those of the bare fallow.

Summary of Results in the North.

I have now brought under your notice the more important of the many facts resulting from the experiments of the Chemical Branch in the Northern areas. We know that the use of the drill, and the application of light dressings of phosphatic manures have now become general in those areas. That the Chemical Branch has been wholly and solely responsible for all this has never yet been affirmed. All honour is due to those progressive farmers who, on their own initiative and without any assistance from the Department, carried out tests on their own farms with no pretence to any knowledge of the underlying principles. The facts that they stumbled on have been of great assistance, for they gave hints to minds who knew how to interpret them—that pointed the way and made it easier. The light dressings of 10, 20, and 30 lbs. used in the first experiments of three years ago, and giving such astonishing results, that are the wonder of European chemists, were suggested by the act of a Victorian farmer: for that idea had its birth in the marked improvement following the pickling of the grain with a few pounds to the bushel only of a phosphatic manure—a method introduced by Mr. Salter. All honour is due as well to our splendid weekly agricultural papers for the wide publicity they have given to the results of manuring, and for their advocacy that the Department should take the matter up as it really deserved to be taken up. In dealing with the work of the chemical branch, I have not forgotten, nor do I undervalue, the other forces working in a similar direction, but without any spirit of boast, it is a performance to create some feeling of pride that this branch has succeeded within the short space of two years in solving the soil problems chemically considered, and as far as cereal crops are concerned, of practically the whole wheat-growing area of the northern portion of Victoria. The great mass of facts already to hand allow us to speak in full confidence of the universal soil deficiency of that area, the manure most cheaply and effectively supplying it—the approximate quantity, taking one year with another, giving the bests results, and the increased yield and probable profits the farmer can rely upon for his expenditure. Such a body of facts is worth a thousand times more than the money required to obtain them.

CROPS UNDER IRRIGATION.*

By A. J. McClatchie.

Most irrigation is done in Arizona by one of two methods—through furrows or by flooding. The furrows may be permanent or temporary. Plants such as strawberries and small vegetables that require the frequent application of small amounts of water, are by most growers irrigated through furrows that are more or less permanent. Some farmers break up by cultivation the crust that forms on the surface, while others simply hoe from the furrows and the intervening ridges the weeds that grow there. This method of irrigation should be resorted to only in the case of such crops and under such climatic conditions as make it difficult to irrigate by any other method.

Furrow Irrigation.

Running water through temporary furrows that are cultivated after each irrigation is to be preferred wherever practicable. Experience at this Station has shown that this is the method by which all crops that can be so irrigated should be irrigated. The water applied penetrates the soil, and a smaller percentage is lost by evaporation than by any other method. Since the soil mulch formed by cultivation prevents the rapid escape of moisture, crops will need less frequent irrigation by this method than by any other.

In irrigating by the furrow method, it is important that the streams permitted to run in the furrows be small. Just enough water to cause the stream to creep slowly along should be turned down each furrow. The soil will thus become thoroughly saturated, and little water will escape at the lower end of the field. The more slowly the water makes its way down the furrows the better, provided it gets through during the time that irrigating water is available. If so large a stream is permitted to run in each furrow that the water reaches the lower end quickly, the sides are thus made less pervious, and a large percentage of the water escapes at the lower end—water that would percolate into the soil if it ran more slowly. For equalizing the flow of water into the upper ends of the furrows, straw or other similar coarse material will usually be found most serviceable. If something is not used to prevent the washing of the soil, the tendency is for too much water to find its way down some furrows, and too little down others.

Flooding.

In the case of crops that cover the ground, such as lucerne and grains, flooding is the method in general practice. In this region these crops are flooded by running a large stream of water between two

* Irrigation at the Station Farm. Bulletin 41, Arizona Agricultural Experiment Station.

ridges, commonly called borders, thrown up with a plough, and about 30 feet apart. Between these two ridges the water being applied spreads out into a broad shallow stream that flows the length of the field. Waste ditches at the lower end of the field carry off the water that flows from the ends of the lands. The first time a field is irrigated after sowing, and to some extent at later irrigations, it is necessary to impede the progress of the stream of water and cause it to spread over the whole surface, where, on account of the slope of the land, it is inclined to run in a narrow stream. This is done by throwing up across its course earthen ridges. If these are properly made they will usually cause the water to flow where it is desired during several subsequent irrigations.

Irrigation before Ploughing.

Before ploughing unoccupied land it is commonly irrigated by flooding. Experience at the farm shows, however, that a better way is to run the water through furrows made 2 or 3 feet apart, the distance apart depending on the nature of the soil and the length of the field. The more slowly the soil takes water and the shorter the field the nearer together the furrows need to be. At the farm these furrows are made with an adjustable three-shovel furrower, by means of which the land can be furrowed as rapidly as it can be ridged. Less water is required by the furrow method, less labour is required to handle the water, and less is lost by evaporation. Moreover, the whole surface of the soil does not become crusted over or baked as it dries, as does land that is irrigated by flooding. In some cases land may be too hard to furrow, and flooding is therefore necessary.

Melons and Pumpkins.

These are planted here from March to June (that is September to December in Australia) along previously moistened furrows, made about 6 to 8 feet apart. Water is run through the furrows, and about two days later the seed is planted along one side, just above the water line. During favorable weather no further irrigation is necessary until after the young plants appear. But if the weather following the planting be too cool for the germination of the seed, the soil about them will often become too dry. In such a case an irrigation a week or two after planting will be important. After the first irrigation the furrow should be cultivated, and a fresh one made for subsequent irrigations, which should occur about twice a month during the first two months. Thereafter more frequent and more copious irrigations will be desirable.

While melons and pumpkins require a large number of irrigations during their growth, the amount applied to the crops is not correspondingly large. This is due to the distance between the rows and to the fact that during the early part of their growth only the furrow along which they are planted is moistened. Thus during the first half of the life of the crop only a small portion of the soil is kept moist, and at no part of its growth is all the surface commonly moistened.

Furthermore, the vines grow so rapidly that undoubtedly a larger proportion of the water is used by the plants and a smaller proportion lost from the soil than is the case with many crops. The covering of the surface by the vines would also cause less loss from the soil.

The common winter squashes used in the Northern States are grown very little here, as they do not endure well the heat of our summers, no matter how much water is applied to their roots. Instead of these squashes is grown the Cashaw Pumpkin, which does well here, and keeps well through the winter. For winter use it is planted during June (December in Victoria), and from the time of planting till the fall needs frequent irrigation.

Sorghum.

The seed of sorghum is sown in the bottom of furrows during May, June, and July (November, December, and January here), and a light covering of earth thrown upon the seed by dragging a bush through the furrows, or by turning a light furrow with a plough, and water run through the furrows soon after planting. Some growers leave these furrows permanently and run water through them every ten or fifteen days. The better way, however, is to cultivate the furrows after each of the early irrigations, and make fresh ones for each subsequent irrigation. After the sorghum has reached such a size that it is not convenient to furrow it, the furrows may be kept for the later irrigations. By this time the sorghum will shade the furrows, and they will not become hard and baked as they will before the crop covers the ground. As this crop is grown entirely during the warm weather of summer, considerable water is required to produce it, but on account of its excellent system of roots not so much as might be expected.

AUSTRALIAN SALTBUSHES IN CALIFORNIA.

It has been said with justice that "a prophet hath no honor in his own country," and the same holds good of fodder plants also. The value of our saltbushes as drought resisting fodder plants has long been recognised in a hazy way, but few, if any, practical attempts have been made in their artificial cultivation, if we except the good work accomplished at the Wagga Experimental Station in New South Wales. The late Baron von Mueller when Government Botanist in this State, never grew tired of testifying to the wonderful value of certain of our indigenous saltbushes, and continually distributed small quantities of seed for trial, but rarely was much trouble taken to propagate them.

While however, we have been backward in utilising nature's special gifts to us, preferring rather a policy of inaction in allowing them to be eaten out or smothered with useless weeds, others, in America and elsewhere, have been struck by the unanimity of the testimony to their good qualities from authorities well qualified to express an opinion.

In the annual report of the Agricultural Experimental Station of the University of California, an account is given of the work at the Southern Coast Range Sub-station in the introduction and propagation of Australian and South American saltbushes. The first valuable species obtained was the well-known *Atriplex semibaccata.* Mr. Chas. H. Shinn, the writer of the report in question, states that:—"During the season of 1897-1898, when the total rainfall was but a little more than four inches, and *all the other field crops failed,* this plant grew all summer, yielding at the rate of one-and-a-half tons of dry forage or coarse hay per acre, and five hundred pounds of seed, also of high feed value. This showing was so remarkable that it was difficult to believe such results, but the experience of three subsequent seasons confirmed them in every particular."

"Saltbush seed was distributed throughout the entire district, to every farmer who would agree to test it. More than two hundred persons sowed seed, and in every case made a success of the crop. Its value was greatest on the light and hardpan soils, as reports from all parts of the county, particularly on the east side of the Salinas, clearly showed. The area devoted to saltbush is steadily increasing. The plant shows some ability to naturalise itself in pastures and by roadsides, but the well-known "fox-tail" chokes it out, as it also does the wild oats, clovers, and other native forage plants. Saltbush, however, can hold its own with our native weeds. In 1900, at the sub-station, saltbush under ordinary field culture yielded at the rate of three-and-a-half tons of dry fodder per acre. One special advantage of the crop for this district is that, if

cut back or fed off about the middle of October, it makes six or eight inches of new growth by the middle of January, long before our native forage plants in this region on similar soils are fit for pasturage."

"During the past few years another saltbush *Atriplex nummularia*, has come into deserved prominence at this sub-station. This species grows tall and is considered one of the most valuable of all in Australia, where it is extensively propagated from cuttings. It is a browsing plant chiefly, and does not furnish hay such as that of *A. semibaccata*, but its drought resistance is enormous and it is probable that, if widely planted, its value on cattle ranges here would equal or surpass that of the latter. Cut once—December 11th, 1901—the plants, then two years old, yielded at the rate of over seventeen tons of excellent green forage per acre. Two cuttings are practicable here, giving a total of from twenty to twenty-five tons of green feed for sheep or cattle. *A. nummularia* here is far superior to *A. halimoides*, *A. vesicaria*, and the other tall Australian species tested. Fifty plants a year old will furnish cuttings sufficient to plant an acre of ground. The cuttings of old wood, made six or eight inches long, should be rooted in boxes of sand, from which they can be transplanted in rows four feet apart, if on poor soil; on rich soil they need more space."

"*Atriplex pamparum* and *A. cachiyuyum* (these two species are now stated to be identical) are two tall-growing species of saltbushes, new to North America and natives of Argentina. They have shown much endurance of droughts and frosts, and produce a large amount of excellent forage on extremely poor soils. As far as tested, they yield somewhat less than *A. nummularia*; but further experience may show them to be more voluable than that species. The plants have not yet seeded here."

"Two rhagodias, *R. spinescens inermis* and *R. linifolia*, have shown great forage value at this sub-station, and also great endurance of drought and frosts, besides containing less salt in their leaves, so that horses, which do not always like the atriplexes, are more fond of the rhagodias. These plants promise more value in the Paso Robles region than at Tulare, where, while growing well, the yield is not proportionately as profitable. This is especially so in the case of *R. linifolia*, which makes a larger plant in the Coast Range on poor soils than at Tulare sub-station on alkali lands."

"At present the only plantations of saltbushes existing in the region outside the sub-station consist of *Atriplex semibaccata*. The largest of these is fifteen acres in extent, near Cholame, but there are many of one acre and upwards. The rhagodias and saltbushes herein recommended can very easily be naturalised over a wide area, and with the prostrate *A. semibaccata* will not only enable farmers to carry their livestock through dry seasons, but will afford more dry-land forage per acre than any other plants tested at the sub-station."

FEEDING DAIRY CATTLE.

By R. Crowe.

(An Address given before the Rural Producers' Conference, at Shepparton, July 1902.)

Perhaps in regard to feeding there is more room for progress than in any other direction. The season just closed stands out as a lasting disgrace to many of those keeping cows, for although it has been pointed out to them over and over again that fodder in plenty should be provided for their cattle when a surplus was available, against the seasons of scarcity, they have in very many cases made no practical effort to follow this sound advice. However, the past season has taught them such a sharp lesson that it is not likely that they will continue to ignore the necessity of doing something in this direction in future.

Ensilage.

The best form of artificial fodder for milk production and health preservation is ensilage. It has been adopted for many years past in various parts of Victoria with very gratifying results. Mr. David Mitchell, of Lilydale, puts down every year a large quantity, and Mr. Syme, Killara, does likewise. Their herds in consequence are in full profit when milk is scarcest, and bringing highest prices. In Gippsland ensilage has been a success wherever it has been tried. Mr. Mathieson, of Trafalgar, has succeeded in making good stacked ensilage. The maize is stacked to a height of 15 feet or so, the stacks being circular in shape and weighted with earth to a depth of 18 inches; a wire fence surrounds them, and when the time for feeding comes on the ensilage is chopped down in benches and distributed by means of a cart to the cattle. Mr. Johnstone, of Heyfield, made his first attempt at ensilage this season, and so profitable has been the result, and so pleased is he that he is now taking steps to increase the quantity of fodder conserved in this way in the future. Mr. D. T. McKenzie, of Calrossie, has also obtained satisfactory results in this direction, the form of silo he uses being well worthy of description. A framed building is put up, that is to say a building with studs 18 inches apart with top and bottom plates, lined on the inside with well seasoned hardwood flooring boards. At the Leongatha Labor Colony a similar structure is provided, lined with tarred paper; while at the Salvation Army Farm at Bayswater, most successful results have been achieved. All these people are making headway enough to prevent any of them ever complaining about the drought—on the contrary a drought is their opportunity for making most money. Some dairymen of course conserve fodder in the shape of hay, but it may be pointed out that hay, although a good food, tends to dry off the cattle, and in the summer time it is not as luscious or healthful a food as ensilage. It has also another very great drawback as far

as our dairying industry is concerned, and that is when good prices are ruling the farmer is tempted to dispose of his hay for export, as did occur in fact last season. With ensilage this is never likely to happen, and if a quantity of food is conserved in such form our dairying industry will not suffer when a temporary demand takes place for hay. In addition to conserving fodder, green crops should be sown towards the end of the spring every year, so as to prolong the period of lactation at the least cost, and in order that when the grass dries off, these green oats, barley or maize for preference, because of the greater weight grown, may be available.

I know that many dairymen when counselled about the conservation of fodder may say that we are speaking in the abstract without considering the difficulties they have to combat, in that when a drought occurs it is impossible to grow green fodder. To them I would point out a number of instances where large profits were made during the current season. The returns secured by Mrs. George Hollier, Sunny Creek, near Trafalgar, particulars of which appeared in the July number of the *Journal*—should serve as an object lesson for all dairymen. A short time ago when on a visit to the Colac district, I called on Mr. Armstrong, who is a director of the Colac Dairying Company, and leases his farm of 500 acres from Mr. L. M. Calvert. He milked for the preceding year a total of 161 cows, and his milk cheques amounted to £1,741. He received a further £200 for pigs, and if the value of his calves be included, his entire receipts totalled about £2,000 for the year. The average return from milk alone was £10 16s. 4d. per head, and the gross return was over £12 per head. Between 30 and 40 acres were cultivated, and the hay, oats, straw, and mangolds grown were all consumed on the place, no fodder being bought outside. Most of his hands were continuously at work, and he had had no trouble with his men. On the contrary, some had been with him for the last twelve years, but he always allowed every man to be off one whole day each week, even in the busiest time. His yard was situated on a comparatively level site, but he overcame the difficulties of drainage by shaping it into formations like narrow ploughed lands resembling a crown and gutter 15 feet apart. No doubt, people in the Goulburn Valley and the North-East will say that both Gippsland and the Western districts are particularly favoured, but there are many examples to be met with even in those places which should serve as incentives to all at any rate of those who are settled on land suitable for dairying.

Irrigation as an Aid.

Even in the present bad year many dairymen have, with the aid of irrigation and practical foresight, secured good returns. In April last Mr. Coliver, near Tatura, was getting 45 gallons of milk daily from 30 cows, which he was feeding on the second crop of sorghum. Another gentleman in the same district milked 15 cows for a yield of 50 gallons per day. He had 120 acres of his farm under lucerne, and used it exclusively for dairying. He kept 36 cows altogether, and received, for milk only, an average return of £10 13s. 4d. per cow for the year. His lucerne

was sown broadcast at the rate of 7 lbs. to the acre. The first crop was cut and fed, then it was irrigated, and afterwards grazed. He had a similar area under amber cane, which grew to a height of 8 feet. A third dairyman, Mr. Lockwood, has 60 acres of lucerne, which he irrigates, and off which he has taken for the six months ending last April £3 per acre for milk alone. Mr. Curtis keeps 12 cows, which he feeds on lucerne, and in the height of last summer, when everywhere else was bare, he was taking 18 gallons of milk to the creamery daily, and made a gross average return of over £11 per head. Mr. Hastings, in January last, was milking 33 cows for 100 gallons daily. Six weeks later his fodder became exhausted, and, notwithstanding the fact that he had three newly-calved cows, his supply fell to 40 gallons daily, and he was of opinion that the period of lactation of his whole herd was shortened by at least two months. He stated that had he had fodder to keep his cows going, he estimated that he would have procured another £100 for milk for the season. He had made preparations by sowing a sufficient area with sorghum, but as the result of an accident, a large portion of it became flooded. Mr. Hobson, who also grows lucerne by the aid of irrigation, has all his cows fit for the butcher, in addition to keeping them in full profit during the height of the summer. If we go to the northern districts right to Kerang, we also find many instances of profitable dairying, notwithstanding the adverse season. Mr. Bott, of Kerang, kept 40 cows for three months on sorghum grown by means of irrigation, the water for which had to be pumped on to the land; when he started feeding his sorghum the supply went up from 37 to 67 gallons in two days, and continued whilst his fodder lasted. Mr. Murphy, of Kerang, also grew sorghum by means of irrigation to a height of 10 feet. He sowed it last December, and irrigated it twice, by means of pumping, at a cost of 3s. 6d. per acre. He took off the first crop in March, and again watered it, and his second crop grew to a height of 6 feet. He calculates that an acre cultivated in this way and irrigated would provide an ample supply of food for two cows for six months. Many others might be mentioned who have met with considerable success in these neighbourhoods by means of irrigation.

Intense Culture.

Even in warmer climates, where more adverse conditions prevail, much is now done by means of irrigation, which Victorian dairymen might seriously take into consideration and give practical effect to. On the 12th June I had some photographs of sorghum grown in Adelaide by means of irrigation, the water for which was raised from a depth of 40 feet with the the aid of an oil engine*. Some 40 or 50 dairy farmers are now dairying there the whole year round, and when supplies are scarce with others they succeed in making most money, irrigating generally from 10 to 12 acres. A well is put down about the centre or at one side of the block. A six horse-power oil engine is used, lifting between 10,000 and 14,000 gallons of water per hour,

* The subjects were selected for me by Mr. A. J. Ridgway, Grange, Adelaide.

1. GALVANIZED IRON FLUMING FOR DISTRIBUTING WATER.
2. & 3. SORGHUM GROWN BY IRRIGATION.

and which will water 1 acre per day of eight hours at a cost of about 2s. per acre for oil. Galvanised iron fluming is fixed to upright posts down the centre of the land to be irrigated with outlets about every chain. Six-inch galvanised iron spouting effects the distribution of the water with calico or canvas connexions. In many cases lucerne is grown, but sorghum is coming more and more into favor every year, on account of its splendid feeding qualities and the wonderfully heavy crops that can be grown by irrigation. Three cuttings are estimated by these Adelaide dairymen to total from 50 to 60 tons to the acre. The first crop grows to a height of 10 feet and even 12 feet in places. The best variety they find to be that known as the "Planter's Friend," although the "Black Seed" variety is fit to cut some weeks earlier, but does not yield such heavy crops. They plant between 10 and 12 lbs. per acre in September or early in October in drills. It needs watering every ten days or so. Barley and rye are sown in February, and are ready for cutting in eight to ten weeks. An area of 8 or 10 acres is thus made to keep up to 40 cows in full profit during the summer and autumn.

THE VARIATION IN MILK TESTS.

By R. T. Archer.

The manager of a butter factory often finds it a most difficult task to convince some of his suppliers that the Babcock test is a correct method of estimating the butter-fat in milk. When a test shows any variation from the previous one the supplier often jumps to the conclusion that it is wrong, losing sight of the fact that the Babcock is a mere machine, while the cow is not, and that the machine, if properly handled, is so accurate that chemists often rely on it when analysing milk.

We frequently hear of suppliers sending two bottles of milk to be tested, representing them to be from two different cows. If the results do not come out the same, the process is immediately condemned, though nothing is more probable than that the contents of the two bottles are quite different owing to faulty methods of taking the samples. Many imagine, for instance, that a correct sample of the milk of any cow is obtainable by merely pouring a portion from the bucket immediately the milking is finished. This idea is entirely erroneous, as the fat is rising all the time, while the strippings, which are the richest part of the milk, never reach the bottom of the bucket. The milk must be poured at least three times from one bucket to another, and the sample then taken if accuracy is desired. Again, those in the habit of testing their cows sometimes test the bulk as a check on the factory. This is a good plan, but it is of the utmost importance that the sample tested shall be a correct one. At the factory the milk is all poured into a weighing vat and thoroughly mixed and the sample then taken gives the true basis for the accurate estimation of the butter-fat in the whole. It should always be borne in mind that a correct sample cannot be obtained by merely stirring the milk in the can, and that a can of night's milk will contain a higher percentage of fat than a can of morning's milk, and since there will be a lesser quantity of the former, the testing of a sample containing equal proportions of the two will give a higher result than obtained by the factory, though the factory will be correct. Suppose there are three cans of morning's milk and two of night's, then three parts of the former must be taken to every two of the latter, or the whole properly mixed before sampling.

I have known a supplier whose milk had been regular in quality to suddenly obtain a very low test and on enquiry it was found that the bottle containing the sample was knocked over while the plug was out, so that some of the cream was lost. Of course, such a test would not be recorded. Cases have occurred in which the samples have been tampered with, cream taken out or water put in. This would certainly be shown in the test, but if the supplier's test had been consistent

a single sudden variation would not be recorded against him, the conclusion being that some accident had occured to the sample. Needless to say, in such a case the manager would like two or more tests to ascertain which was correct.

There are many causes of the variation in the fat contents of cow's milk which sometimes show astonishing changes. In Bulletin No. 24, Illinois, U.S.A., is the following record of the variation of one cow's milk during a period of nine months :—

	Average for Month.	On Any One Day.	
		Highest.	Lowest.
December	3·8	4·9	3·0
January	3·7	4·6	2·7
February	3·6	5·9	3·2
March	3·8	4·7	3·4
April	4·0	5·8	3·0
May	3·8	4·6	3·2
June	3·9	4·6	3·2
July	4·2	6·2	2·8
August	4·7	7·9	2·9

The largest variation in two successive months is 0·5 per cent., July and August. The greatest difference in any two months is 1·1 per cent., February and August. The highest test on any one day is in August, 7·9 per cent., and the lowest in January, 2·7 per cent., difference 5·2. The largest variation on any one day was 7·9 to 2·9, a difference of 5·0 per cent.

The Journal of the Highland and Agricultural Society of Scotland gives the results of upwards of 700 analyses of the milk of eighteen cows over a period of 21 days, each cow's milk having been collected and analysed separately morning and evening. Amongst the conclusions arrived at it is stated that the proportion of fat in genuine cow's milk is liable to greater variation than is generally admitted. Samples containing less than 3·0 or even 2·0 per cent., may often occur while the same animals may, within a few days, yield milk with 5·0, 6·0, or even 7·0 per cent. of fat. Of course, the average tests of whole herds will not vary to so great an extent, but as a general rule, it may be taken that what will affect a single cow will also, more or less, affect the herd. The tests of the Jersey herd at the World's Fair, Chicago, 1893, will illustrate this.

July 16th.	4·8
,, 17th.	5·0
,, 18th.	4·7
,, 19th.	4·6
,, 20th.	5·0

The greatest difference was from 19th to 20th, 0·4 per cent. According to Fleischman, one of the greatest authorities on dairying, the test of a herd may go more than 30 per cent. above or below the average for the year. For example, if the herd's average test is 5 per cent. on some days it may be as high as 6·5 and others as low as 3·5. The same thing has been proved in England by Lloyd when conducting investigations for the Imperial Government in 1895 at Hazelbury in Somersetshire. The average test of the herd was :—in April 3·7 per cent., May 3·39, June 3·5, July 3·6,

August 3·8, September 3·9, October 4·39. Lloyd also found that the average test of one herd, during a period of drought, was very much lower than it had been in the same herd the previous year. Innumerable instances to the same effect could be given of investigations in nearly every country where dairying is carried on.

The variations in test may be divided into three classes. (1) Those that are natural and progressive. (2) Those that are rather accidental and usually temporary. (3) All the variations whose cause is unknown. The widest and most common variation is due to the period of lactation. It is well-known that a newly calved cow's milk tests low, and that her test rises as she becomes a stripper. The second class of variation is produced by a number of different causes. There is usually a difference between morning's and evening's milk, the milk drawn after the shortest period is the richest, although, when cows lie still the milk will test less. The variation in the test of milk first and last drawn, is very great, the first drawn being poorer in butter fat, and differences as wide as one and ten per cent. in the first and last few pints have not infrequently been noticed. There are a number of conditions that disturb the percentage of fat in milk, sometimes by decreasing it, and generally becoming more pronounced for several milkings, but even though the gradual return to normal conditions may cause the quantity to reach the former level, the quality remains inferior, so that there is, on the whole, a considerable falling off in the total production of milk and butter fat. These conditions are rough treatment, exposure to rain and bad weather, change of feed, change of milkers, speed of milking, unusual excitement or sickness, shortness of feed, &c.

Lloyd found that a herd fed on one paddock in October for six days gave an average test of 5·1, and for the next sixteen days on another paddock 4·68. In this case the fat content of the milk is controlled by the nutriment in the food, and this by the nature of the soil and climate. Mr. Wyatt, of the Yarram Butter Factory gave me an instance of a cow which tested 5·8 at Woodside, some distance from Yarram, and when removed to Yarram the test dropped to 4·6, and although the cow was fed as much as she would eat the test was not increased above 4·6.

There, I think they must have the herd with the record low test. It was tested by Mr Potts, September 9th, 1898 ; No. 1 was 2·8 per cent. of fat ; No. 2, 2·2 ; No. 3, 2·8 ; No. 4, 3·6 ; No. 5, 3·0 ; No. 6, 2·9 ; No. 7, 2·4 ; No. 8, 3·2 ; No. 9, 2·8 ; No. 10, 2·8. The average being 2·85. These cows would not give a payable return for the food they ate, and I am afraid many farmers have cows equally bad, which are, in reality eating up the profits of the other and better animals.

Every farmer should have his cows tested regularly, and fix a standard, and by the scales and Babcock cull out all below that standard and spay them. If all dairy farmers will adopt this plan, their output may be doubled without increasing the number of cows. With this end in view the officers of this department will teach any farmers how to use the machine and work out the tests.

THE SOUTH AFRICAN BUTTER TRADE.

By J. Kirk Hunter.

Increasing Competition.

This trade is one of such magnitude that every country that can lay any claim whatever to the production of butter is making an endeavour to secure a footing in the market, and it is a somewhat striking illustration of the trend of the trade that the two countries, Argentina and Canada whose butter is mostly spoken of here at present, do not appear in the list of countries whence butter was imported during 1901. The unfortunate drought, which has existed in Australia, provided them with an easy opportunity of establishing themselves in the market, of which they have not been slow to make the most. The Argentine exporters particularly have been most energetic. They have established agencies, and suceeded in securing a considerable amount of business.

The following are the imports for 1901, from which it will be seen that Victoria's contribution is more than half the total, and the supply from the Commonwealth exceeds two-thirds :—

United Kingdom	718,127 lbs.	£38,782
Natal	122,303 ,,	6,918
New South Wales	1,193,060 ,,	57,333
New Zealand	109,351 ,,	5,331
Queensland	191,032 ,,	9,148
Tasmania	544 ,,	37
Victoria	3,337,096 ,,	176,651
Belgium	13,640 ,,	867
Denmark	380 ,,	27
France	5,434 ,,	418
Germany	36,884 ,,	2,694
Holland	304,822 ,,	18,892
Delagoa Bay	10,000 ,,	751
States over the Border ..	43,208 ,,	3,739
Other countries	152 ,,	2
Total ..	6,086,033 lbs.	£321,590

I have endeavoured to obtain the statistics of imports for 1902, but the Customs staff is so busy preparing the annual returns for the Government that they cannot possibly let me have them for three or four weeks.

One or two Australian agents that I have spoken to regarding this trade appear to treat it somewhat lightly, and seem to think the return of good seasons, with better supplies, will mean also the return of the trade that at present is going to the Argentine. That is not my opinion. Argentine butter has come to stay, and its position in the market will be strengthened by the remedying of any little defects of method that may exist in the production at present. I hope, therefore, Victorian firms engaged in the trade will attach due seriousness

to the strength of their opponent, and adopt every means possible to retain the trade and maintain the high reputation of their produce.

A considerable quantity of the butter received during the last few months in execution of Victorian orders has been New Zealand made, the boxes being so branded. This is not good for Victoria, and I have been told that "if it is good enough for your exporters to fill my orders from New Zealand, it is good enough for me to go there direct for my requirements." I fear that my explanation that it was only under very exceptional circumstances, such as then prevailed, that such a course was necessary, failed to convince the gentleman spoken to that he should continue in the same groove for his requirements.

The conditions and fluctuations of the Australian butter market are very closely followed here by those engaged in the trade, and they have not failed to notice that recently considerable quantities have been stored "for a rise" during the autumn and winter months. For this to be a successful move necessitates the condition that there are no other competitors capable of keeping the price down, and I am not sure that such a condition now exists. It may have been successful in the past, but then Argentine was not competing on the extensive scale that she is now, and if she can continue to supply the African market with the quantities I am told she is capable of supplying, it would appear to be a mistake for our exporters to store too much or too long, and it is desirable they should watch closely how it is likely to affect them.

Argentine Butter.

During the course of my enquiries amongst the merchants here and in Durban and elsewhere, I find that many of them are importing Argentine butter, and speak very highly of it. The retailers also regard it favorably, and I have not met with any instance of a complaint having been made.

The readiness of the local importers to adopt this Argentine butter is due mainly in the first place to its being placed on the market at a time when Australian supplies were short, and prices high, and having gained the *entree* to the trade because of their lower prices, they have, by supplying a uniformly good article, succeeded in establishing a reputation for quality and value that cannot fail, if maintained, to mean the rapid growth of their trade.

I learn from those who have been to the Argentine and know the conditions of the dairying industry there, that the continuity of supplies is assured, and that preparations are being made for next season that will make them very formidable competitors indeed.

One large firm here informed me that the agents of several Australian firms had intimated to them that butter would be very dear later on. To protect themselves against this anticipated rise they took advantage of the prevailing low price in Argentina and placed a contract for six months' supplies at 10½d. f.o.b. Buenos Ayres, and I

believe a number of other firms here followed the same course. As the import charges are slightly lower than from Victoria, this butter will not cost more than 10¾d. c.i.f.

This butter is one of the best known and most favourably regarded Argentine brands—"El Pampa"—and is made in three classes, namely :—"Unsalted," "Mild" and "Salt." I procured a sample of each and submitted them to Mr. Woodin, the Dairy expert at the Cape Government Agricultural College, for his opinion. I also sent a sample of Canadian, and he reports on them as follows :—

1. "The sample marked 'Unsalted El Pampa' I should say has been treated with brine, as it undoubtedly is slightly salted, but not heavy enough to retain its flavour, which I should say when freshly made was good. The aroma and texture are fairly good and the sample is well freed from water."
2. "The sample marked 'Mild El Pampa' runs the 'Salt El Pampa' very close, but is lacking in texture and the flavour although good is not clean and distinct, neither is it so firm as the 'Salt El Pampa,' although I consider the aroma of this sample the best of all."
3. "The 'Salt El Pampa' lot is the best all round sample, the aroma being fairly good, the colour the best of samples, the texture is the best and the sample was fairly dry, the flavour being cleaner and better than any other lot."
4. "The lot marked 'Canadian' I do not consider a good sample, although perhaps the dryest and firmest of all the samples, it is the most greasy in texture and has not a fine butter aroma or flavour."

One firm that formerly handled Victorian and New South Wales butter in large quantities became dissatisfied with the quality of the consignments coming forward, and recently placed big contracts with a South American firm at 11d. per lb., c.i.f., while expressing the intention of "giving the Australians a go for the trade."

Quality Must be Maintained.

It can hardly be denied, and is much to be regretted, that a good deal of the complaint and dissatisfaction amongst importers regarding Victorian butter is justified by the considerable quantities of low grade qualities lately received, and the time has arrived when, if the trade is not to suffer permanent injury, exporters should take every care to maintain and protect the reputation and standard quality of their individual brands. That many instances exist of recent shipments indicating that this precaution had not been taken can be easily gleaned in the course of conversation with local importers, and it cannot but recoil disastrously upon the exporter. This I think some must have already discovered. In some instances the butter sent has not been equal to the quality previously received under the same brand. This has caused a strong feeling of dissatisfaction and distrust, and created the desire to change to other markets if favorable conditions are obtainable.

When a brand has become well established in the market, and secured a high reputation for its excellence and uniformity of quality, then under all circumstances these features should be preserved, and if the state of the producing industry at any time is of an abnormal character—such as recently existed—and the standard of quality which made the reputation of the brand cannot be continued at the old quotation, then the price should be raised, and the quality maintained: If the customer cannot or will not give the higher rate, then another grade, no doubt, could be supplied at his limit, but under a different brand, and with the distinct understanding that it is not the same quality as previously had, until such time as the market again permits of the original brand being submitted at or about its former price.

Fluctuation of price we know is unpreventable, but the exigencies of the market should not be met by variation of quality.

THE HOP INDUSTRY IN VICTORIA.

By D. McAlpine.

When Minister of Agriculture, some three years ago, the Hon. Geo. Graham directed that investigations should be made in order to ascertain the reason for the decline in the production of hops in this State, and also decided that experimental work be undertaken in the endeavor to place the industry in a more satisfactory position. It was necessary first of all to obtain some explanation why our local hops command such low prices in comparison with the imported, and in this phase of the work Mr. A. de Bavay, F.C.S., was associated with me.

As regards quality it is well-known in the trade that the Victorian hops do not generally compare favorably with the imported ones, especially the choicest Bohemians, and this is the principal reason why some of the brewers, at least, are willing to pay two or three times as much for these choice hops as for the Victorian. The use of these hops is likewise an absolute necessity for the production of lager beer, on account of their special flavor and aroma, and the same may be said of Kent hops. They are used only for the better class of beers, and when it is desired to produce an article similar in some degree to English beer. This question of aroma and flavor is a most important one, and although these qualities are not capable of exact definition yet the best prices are only paid for those hops with an agreeable odour. They vary with each variety of hop, the country in which they have been grown, and very often the same variety will produce hops varying greatly in quality and value, even when grown in adjacent parishes.

It is evident, therefore, that the first step towards improvement will be to import some of the best varieties from those countries producing superior qualities, and test them in various hop-growing centres, with different soils and varying altitude. Of course, it does not necessarily follow that these imported hop-plants will produce here hops of the same high quality, but it is quite possible that one or two varieties may be found exactly suited to our special conditions. Hitherto the trials in this direction have not extended beyond a few varieties of English hops, and in some districts Goldings alone are grown. No doubt the better hops are generally grown in the cooler climates, but there is such a great variety of climate in Victoria, at different altitudes, that I see no reason why we should not find the exact place where some of these varieties could be grown to perfection.

That this is quite possible is shown by what has been done in America. American hops were formerly very inferior and particularly coarse in flavor, but now, by improved cultivation, better curing, and improvement in the varieties grown, great advances have been made,

and some samples from that country are at the present day everything that could be desired.

Imported Varieties.

Accordingly steps were at once taken to secure sets of some of the best varieties for planting, including Bohemian, Bavarian (Spalt), Kentish, and Californian. The Agent-General consulted with several experts at Canterbury and Maidstone in Kent, and acting upon their advice the following varieties were sent out:—Bramling, Early Bird, Cobb's Hop, Fuggle's Hop, Canterbury Golding.

Mr. Geo. Mount, of Canterbury, who supplied the sets, advised as to the best method for planting as follows:—"Make holes about 9 inches square with spade, put set in, top of set just level with ground, put fine soil in and firm gently with your foot.

"If for pole work, they are planted about 6 ft. 6 in. apart each way."

"If for wire work I plant 7 ft. 6 in. one way and 3 ft. 3 in. the other way, that is, along the wires."

In some of the hop plantations here the distance between the plants is 7 ft. 6 in. to 8 ft. 6 in., and sometimes 8 ft. 8 in., so as not to interfere with the cultivation.

The sets on arrival in February, 1901, were placed in charge of Mr. Boyce, at Deepdene Nursery, where they were carefully planted out and rendered available for distribution in July.

A large number of hop-growers made application for sets, and they were supplied as far as possible, but six stations were chosen in different parts of the State for special planting, in order to have as great a variety of soil, climate, and altitude as possible, viz.:—Bairnsdale, Harrietville, Timboon, Milawa, Coranderrk and Leongatha Labor Colony.

Several consignments of Bohemian and Bavarian hop-sets have arrived here, but in every case they were dead. However, instructions were sent as to the best mode of packing and treatment in transit, and it is to be hoped they may yet reach us in a fit condition for planting.

The sets used in California have also been obtained, particularly the variety known as the Large Gray American, and since the climate there is somewhat similar to our own, their introduction is likely to prove successful.

Male and Female Plants.

The Hop-plant belongs to the nettle family, and has the male flowers on one plant and the female on another. The sexes are readily distinguished by the flowers, since the male flowers are small, greenish-yellow, borne on slender stalks and arranged in loose bunches, while the female flowers are much smaller, without stalks, and arranged in compact egg-like groups. If the male plants are allowed to grow they

fertilize the female flowers, and thus produce the so-called seeds, which are really fruits, about the size of hemp-seed. The hop-plant being what is called a "wind-hybridizer," the pollen being carried from the male to the female by the wind, the vicinity of the male plant is usually sufficient to ensure fertilization. The question of seeds in hops is an important one for the grower since he wishes to supply the requirements of the brewer in this respect. Brewers with only a local experience have always shown a marked preference for samples heavy with seed, their contention being that they impart a tinge of bitterness, not obtained by seedless samples, which makes the beer more palatable, in fact, they flavour the beer. One grower told me that he started without the male plants, and the hops seemed to do fairly well, but since the brewers wanted the seed in the hops, to supply the demand he imported male plants from New Norfolk, Tasmania. Hence most of the hop-growers introduced male plants in order that they might comply with the demands of the trade, and some believed that they were absolutely necessary, since, as they said, "no male plant, no hop." But the brewer with modern ideas prefers seedless hops, since he knows that while seeds increase the weight of the hop, the percentage of desirable qualities is naturally smaller.

If hops were grown for the sake of their seed, then the male plants should be encouraged, and every facility given for the fertilizing pollen to reach the "brush" or stigmas of the female flower. But, as far as the brewer is concerned, the chief value of a hop depends upon the amount and nature of the lupulin present in it. This lupulin is a secretion produced by glandular hairs, which gives to beer its bitter taste and distinctive aroma, and occurs on the bracts of the female cone or "strobile" as it is called, in the vicinity of the seed-forming portion of the flower. It is evidently produced preparatory to and as a protective arrangement for the young "seeds" to be afterwards formed, and so efficient is it for this purpose that even the omnivorous sparrow avoids the fruit during the period of ripening.

But the mistake that has hitherto been generally made is to regard the lupulin as being dependent on the formation of seed, and some growers consider that with no seed there will be little or no lupulin. Professor Emanuel Gross, however, in his work on hops (1900) shows that this notion is without foundation. He writes :—"At one time the formation of lupulin granules was believed to stand in causative relation to the fructification of the hop, and it was in consequence of the belief that fructified hops were richer in lupulin that the custom arose of planting about five male hops to every 1,500 female plants. Nowadays it is known that the formation of lupulin is independent of fructification, and that hops containing seed bring lower prices so that this old practice has been abolished." And Professor Lintner, in forcible language writes :—"A hop garden should resemble a nunnery, all males being excluded." The fact that Bohemian hops, which are now taken to include Bavarians as well, of the best quality are absolutely free from seeds, and that they are most in demand, and command the highest price, shows that the seedless samples are

considered the most valuable by brewers generally. Some growers object to the male hop on quite different grounds. It is an early grower, and gets ahead of the female, and this luxuriant growth forms a splendid breeding ground for the red spider, just as the early sorts do.

Resins in Hops.

Hops are used in beer with several objects in view. Flavor and aroma are very important, but they are not everything. The hops must contain in addition a large quantity of the right kind of resins, for to them are due the preservative action as well as a good deal of the bitterness so much appreciated by conoisseurs.

According to Hayduck, the hop-resins are of three kinds. The two first are termed "soft," and are credited with a certain antiseptic property preserving the beer from the attacks of bacteria. The third variety known as "hard" is without such antiseptic action and considered of no value in brewing.

By storing the hops under defective conditions and by age the soft resins are changed into the third or hard resin and consequently are thereby greatly impaired in value. Even where the air is excluded a portion of the soft resin is gradually converted into the worthless resin. In order to show how greatly hops vary with regard to the value and amount of the resins contained in them, De Bavay collected samples of the various hops in general use in Victoria and made an analysis of them.

The following analysis of average samples are supplied by him, all but the figures relating to Victorian hops being taken from Briant, F.C.S. :—

Average.	Hard Resin.	Soft Resin.	Total.
Victorian Hops	6·95	8·60	15·55
East Kent ,, ...	3·91	10·65	14·56
Sussex ,, ...	5·30	9·12	14·42
Worcester ,, ...	5·12	7·60	12·72
Goldings ,, ...	4·25	11·23	15·48
Californian ,, ...	8·45	12·20	20·65
Bavarian ,, ...	8·20	11·30	19·50
Best Columbia	8·55	12·30	20·85

Aroma and flavour of hops can only be tested so far by practical trial, but apart from these, the hops containing the largest quantity of soft resins are considered the best.

Training the Hop.

The two principal methods of training are the pole-work, in which the old-fashioned poles are used, and the framework with wire or string. Various materials are used for poles in Victoria, according to the district, but generally gum-tree, such as stringybark or messmate,

and tea-tree. Three poles are commonly used to the set when the ground is rich, and they are preserved in various ways, the simplest being to char the wood, or to creosote the poles at the base. But wood impregnated with bluestone solution is very durable, the poles being immersed in a 30 per cent. solution or 3 lbs. of sulphate of copper to one gallon of water. While pole-work is more common in Victoria, several are going in for the post and wire system, which is also being generally adopted by the larger growers in Tasmania. The poles and wires, however, are not so numerous as in England, since all the cultivation is done with horses in the larger plantations. String, instead of wire, is now coming into use, on account of its cheapness. It is certainly weaker than wire, rots easily, and tears at the point of union with the horizontal wires, but its resisting power may be increased by steeping it in a 3 to 4 per cent. solution of alum or bluestone.

In Kent, as stated by Mr. Hall in the *Journal of the Board of Agriculture* for March, 1902, "poles are giving place to permanent structures of wire strained on stout posts; to the wires are laced each year strings of coir yarn about ¼ inch in diameter and with a breaking strain of about 50 lbs., up which the hopbine twines."

Comparative tests in the same garden on plots poled and plots where the hops were grown upon string and wire, showed that the average crop was 10 to 23 per cent. better on the latter. The uneven ripening of the crop, and the weakening of the stock and subsequent loss of crop caused by cutting away the bines at picking time, are also drawbacks to the pole system. The poles are looked upon as a refuge for the red spider, and the use of wire frames is recommended as a preventive.

The material used for tying the bines is often reeds or rushes growing in the neighborhood, but flax is sometimes employed.

Time of Hop Picking.

Not only does the quantity of these resins vary with the variety grown, but also greatly according to the time the hops are picked. If the hops are picked green, before maturity, there will be a deficiency of resin, and on the other hand if allowed to become over-ripe there will be a loss of resin; consequently it is of prime importance that the hops should be picked at the right time, when there is a maximum of resin present, and this is just a little prior to full maturity, and the resins are still too adhesive to be lost by the shaking attendant on picking.

Drying Hops.

Another matter that should receive the careful attention of growers is to dry their hops as soon as possible after they are picked. If this is not attended to the hops will heat and ferment, their appearance will become brown or reddish, and they will even go mouldy, losing their aromatic flavor in a very short time.

Mr. de Bavay considers that imperfect or too late drying is responsible for a good deal of our inferior hops. He says:—"I am convinced, from the many samples of inferior hops I have seen in this country, that the kiln-drying of the hops is not always well conducted or well understood, and that many of our growers do not possess kilns of the right construction. Too much heat, especially when the hops are still moist, will spoil the best hops, for not only will it brown them, but it will make them lose the best part of their aroma."

"What is required are kilns well away from the fire, and with great draught. In fact, practically speaking, the fire should only be there to dry and purify the air." The hop-kiln shown is considered one of the best in Australia, and was constructed by Hiram A. Crawford, at Brookfield, Everton. It is built of brick, and the roof slants up to the top on which rests a cowl to keep out the rain. The roof consists of shingle, because when sulphuring the hops the escaping gas makes holes in an iron roof. In the centre of the kiln is a platform, on a level with the drying floor, and to this the green hops are brought immediately after picking. The landing floor is battened lengthwise, to put the bags on and to keep them cool. The furnace room is situated at the base, and the elevation of the drying floor is 12 ft. although it is generally reckoned that this should be not less that 20 ft., in order to give the heat a better chance of spreading, and as a precaution against the scorching of the hops.

The hops must dry in a draught, and therefore good ventilation is provided. The drying room floor is covered with hessian, and the hops are spread out on it as evenly and as lightly as possible about 1 ft. deep, although a depth of 2 ft. is not amiss.

The best temperature for drying is considered to be about 130 deg. Fahrenheit, and the hops are left for about 12 to 14 hours. To allow the air to pass through them they should be turned or stirred. The best charcoal for heating purposes is made from red gum.

The cooling room adjoins the drying kiln, being a few feet lower than the drying room, and is 90 feet × 30 feet. It has a corrugated iron roof which is lined with calico to keep it cool. The hops are taken out of the drying room when ready and put in one big heap for 4 or 5 days before pressing. This is done by a hydraulic press for which hand-power is used, since it acts slowly and gives an enormous pressure. Then the room below the cooling room is used for packing and storing, where the hops are kept both cool and dark and free from draughts so that the aroma is not driven off.

It will be observed that the cooling room is convenient to both drying rooms so that the hops when taken out of either can be placed wherever most convenient.

HOP KILN AT EVERTON.

AIR-TIGHT HOP CYLINDERS.

Sulphuring Hops.

Opinions are divided as to the value of sulphuring but the following points are urged in its favour:—

1. The acid destroys the mould fungi which are the principal cause of deterioration during storage.

2. Moisture is absorbed less readily by sulphured than by unsulphured hops.

3. It improves the colour of hops deficient in this quality and thus increases their market value.

Where this practice is followed, it should be done properly and not merely by throwing a handful of sulpur on the fire. To be successful it should result in practically destroying the micro-organisms in the hops, whether the germs are derived from the air or are present in the hops themselves. T. Behrens found 13,000,000 bacteria in 15 grains of unsulphured hops and how could such hops be expected to keep for any length of time. In Bohemia special machines for sulphuring the hops are used with great success, and Victorian growers would do well to take a lesson from the best growers in Bohemia where they have had centuries of experience.

Storage.

In Victoria the hops are compressed in bales because it is done in England, but it ought to be remembered that in our hot and relatively dry climate, hops deteriorate far more than they do in colder countries.

De Bavay pertinently says :—" Why should Victorian growers not pack their hops in air-tight cylinders, as is done in Austria with the specially prepared hops for Australia. My experience has proved that if properly cured hops are packed loosely in these cylinders and stored at a low temperature, their value is immensely increased. The cost of the cylinders would only be a first expense, since the brewers would return them when empty. The growers would thus obtain better prices for their hops, avoid losses in weight by evaporation, and avoid deterioration through faulty storage."

It has been proved in practice that sulphured, pressed, and well-packed hops will keep for two years and more in good condition.

As regards cool storage, it may be mentioned that several of the large English hop merchants have employed cold storage successfully, and some have cooled their store-rooms down to — 5 deg. C. by the aid of refrigerators. However, others are content with a temperature of 2 deg. to 3 deg. C.

The accompanying illustrations show the hop cylinders filled with Bavarian hops, kindly placed at my disposal for photographing by the Foster Brewing Co. They are made of strong galvanized iron, are 4 ft. 4 in. deep, and 2 ft. 4 in. in diameter, carrying about 2 cwt. of hops. The movable lids are fitted with air-tight packing rings, and there is generally an aperture in the centre with a tap, so that

sulphurous acid gas can be injected under pressure after the lid is closed. The hops are all hand-pressed, and not with hydraulic pressure, since the latter process crushes the lupulin cells and ultimately induces fermentation.

These cylinders will last for several seasons, and since the initial cost in Melbourne is only 12s. 6d., and they can be returned as empties by the brewers, a trial should certainly be given to this simple method of packing.

The Red Spider or Mite.

This minute pest seems to be the most troublesome with which the Victorian hop-grower has to contend, and in few cases is it absent from the hop plantation. From Timboon, where some of the finest hops are grown, one writes that the spider does not trouble him, but this is exceptional. In fact, many regard it as the greatest hindrance to the success of the industry. Mr. Donald Gow, of Harrietville, who started hop-growing a quarter of a century ago, considers that the loss of quality in the Victorian hop is due to this pest. He says that it makes its appearance on the lower leaves about the time the hop reaches the top of the pole, and increases in numbers, attacking leaf after leaf in ascending order. By the time the strobile is formed, the spider has taken all the substance out of the leaves, and then they start on it, extracting the lupulin which is the essence of hop.

The hop-grower, from past experience, seeing the spider start on the strobile begins picking, before it is anything like ripe, to save his crop from total destruction. It is almost useless to gather the crop, because it is unsaleable or nearly so. If we could get rid of this pest, perhaps our hops would improve in quality.

Another grower writes to ask if there is any remedy to cope with the red spider besides spraying the vines, which, with a low price, would not pay to do.

The subject of insect and kindred pests is ably dealt with by my colleague, Mr. French, who has described and figured the red spider in his *Handbook of the Destructive Insects of Victoria, Part I.* He informs me that either spimo or kerosene emulsion will kill *all* the red spider necessary, but if the old poles, plants, &c., are allowed to remain near to where the new sets are planted, the latter are certain to take it.

Statistics.

There has been a gradual decline in the area under crop and the number of persons engaged in the industry. For the year ended 1st. March 1902, there were only 66 hop-growers in Victoria, and the area is returned as 307 acres. It will be seen from the accompanying return that the quantity of hops locally grown in the 1901 season was the smallest during a period extending over seventeen years.

RETURN showing quantity of hops locally grown and imported during the years 1885-1901 inclusive :—

Hops Grown in Victoria.		Hops Imported.
Year.	Lbs.	Lbs.
1885	1,573,936	Not Available.
1886	616,112	503,864
1887	562,576	325,835
1888	605,360	546,792
1889	618,128	788,968
1890	639,632	496,965
1891	888,272	784,654
1892	729,456	330,576
1893	848,176	181,462
1894	636,608	233,261
1895	515,536	251,374
1896	441,952	375,862
1897	692,496	521,731
1898	406,336	698,014
1899	767,088	536,753
1900	323,008	931,231
1901	306,992	691,238

NOTE.—The year for Victorian grown hops ends on March 1st., the imports refer to the Calendar Year.

Conclusion.

Now that the hop-sets have been distributed to the most experienced growers in the principal hop-growing districts, it will devolve upon the Agricultural Chemist, Dr. Howell, to bring the work to a successful issue. It will be necessary to see, not only that the imported hops grow well in a given district, but that they have the necessary amount and requisite proportions of the soft or preservative resins, upon which their value from the brewing point of view largely depends. In order to obtain the best results, the picking, the drying and the packing will require to be done in the most approved manner. The brewers have pointed out their requirements, and it will be to the interest of the growers to satisfy these as far as possible, viz. :—"A well-ripened hop, skilfully dried and carefully managed, so as to leave the cones unbroken and in possession of their full value of resin and other qualities."

Besides an analysis of the resins, &c., in order to compare results with the imported article, the action of manures in increasing the yield and improving the quality will require to be tried. There has been a good deal of rough experimenting on the part of growers themselves and quite a large number of substances applied; as one put it, "nearly every kind of manure has been tried," still there is a lack of definite information on the subject, particularly in regard to the most suitable manures for the different soils on which the plants are grown.

Mr. Barker, of Whorouly, writes :—" As a rule we get the best yield in the district, and also the top market price for our hops. This is mainly owing to our having experimented and found out which are the best artificial manures to use in order to obtain a good yield and also good quality." These are some of the measures which are likely to be of use in improving the quality and thereby increasing the price of our hops, but the introduction of fresh sets of the best varieties, and the consequent improvement of Victorian stocks, should of itself have a beneficial influence on the hop industry.

VINE PRUNING.

By Joseph Perrand, translated by Raymond Dubois and W. P. Wilkinson.

(*Continued from page 606.*)

V.—Pruning in Beaujolais.

In Beaujolais vines are trained low, after the gooseberry bush fashion, carrying three or four arms, also called "horns." These horns generally carry one spur of two eyes (Fig. 39). The plants are usually supported by stakes during the first years (Fig. 38), but when they attain the age of eight or ten years the stakes are

Fig. 38.
Vine of Beaujolais before pruning.

Fig. 39.
The same after pruning
(after Foëx.)

removed, the vines being strong enough to support themselves. They are often fastened two or three together (Fig. 40). This is not an advisable system for rainy and cold climates, for the grapes, buried

Fig. 40.—Old vines fastened together (after Foëx).

under a mass of leaves and deprived of air and sun, do not ripen easily and are liable to non-setting and rot. Since the reconstitution of

vineyards with American vines the stake is permanently maintained, on account of the greater vegetation of grafted vines.

The first year the vine is pruned back to the eye closest to the ground. The second year it is pruned back again to one eye, and the third year the crown is formed at from 6 to 10 inches above the surface of the soil.

On hilly ground the crowns are kept as low as possible, while on low ground on the contrary, they are formed rather high to avoid in a certain measure the action of frosts. The third year two or three shoots are left in suitable positions, pruned with two eyes, ultimately forming the arms or horns. The following years, if the vigour of the vine allows it, an extra arm is added and one spur (or rarely two) of two eyes, is left. With this method the arms lengthened every year, and nothing is done to prevent the accumulation of old wood; and it is common, in some districts, to see old vines carrying arms often reaching 3 feet in length.

This practice should certainly be discarded, for it weakens the vegetation of the vine, which loses in fertility on account of excessive elongation. One could easily remedy this and endow the plant with new vigour by practising the operation of lowering, which we mentioned when studying the pruning methods of Languedoc.

But this system will, perhaps, never be adopted by the vignerons of Beaujolais, for they believe that "old wood produces good wine." There would be a means of reconciling the old custom and rational principles by establishing a periodical rotation in the renewal of these horns, so that the plant would always carry two or three old horns, which would never reach the excessive dimensions often met with.

The Gamai, which is exclusively cultivated in Beaujolais, would be very well suited to this mixed system.

All the vineyards we have studied so far present great analogy in their modes of training. Low crowns and gooseberry bushes with spurs are the rule.

VI.—Pruning in Gironde.

The vineyards of Gironde have been divided into different regions, although as a whole they have cultural methods, products, and conditions of soil and climate in common. From the point of view we are studying now, we find noticeable differences in the systems of pruning adopted in each of these regions.

In Médoc the vines are trellised after the spalier system, with two arms symmetrically placed on both sides of a main stem, formed

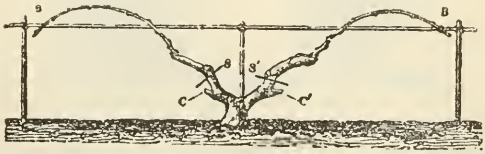


Fig. 41
Médoc vine with two long rods and two spurs (after Foëx).

like a "V," each arm carrying a long rod B B′ (Fig. 41) termed *aste*, and a spur with two eyes C C′ called *cot*. The object of the *cot* is to produce rods to replace the *aste*.

Vertical shoots, named *tirets* T T′ (Fig. 42), are sometimes substituted for the *cots*, and fastened to the horizontal laths of the trellis, all the eyes, except the two base ones, being rubbed out. This modification offers a certain advantage, for the replacement shoots, growing vertically, become much stronger than if grown in any other position, and form excellent canes to replace the old rods after they have borne a crop.

The mode of training vines in Médoc is extremely simple. The plants are spread evenly on both sides, supported by small frames formed of three short vertical stakes, 15 inches in height, joined by a

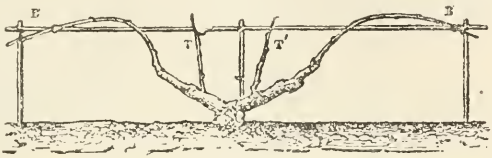


Fig. 42.
Médoc vine with two long rods and two *tirets* (after Foëx).

light lath fastened horizontally at their extremities. When the vine is three years old, two arms S S′ (Fig. 41) are formed, each carrying a cane with from three to five eyes according to the vigour of the vine, that is to say, the whole length of the cane is retained with three to five base eyes, all other eyes being removed. This allows the cane to be fastened on to the little frame. To avoid the elongation of these arms, shoots C C′, grown on the old wood, are pruned with two eyes during two years and the arms S S′ are pruned back above these, which constitute new arms.

If the vine is too old it is pruned back or lowered more severely. One of the shoots growing naturally on the trunk is retained and pruned with one eye. It gives a vigorous shoot, which is pruned the following spring with two eyes, and the old arm is pruned above this spur, which forms the new arm.

Different summer prunings are practised in these vineyards. All suckers growing on old wood or under the collar of the plant are removed (disbudding and suckering). At the flowering season the green shoots are cut back with a kind of long-handled sickle; they are all cut at an even height (topped) and regularly trimmed on the side (slashed). These operations are sometimes repeated in July* before the vintage.

If the season is very wet, and the vegetation luxuriant, the leaves are stripped to gradually expose the grapes to the solar rays, and enable them to ripen easier.

*January in Victoria.

In the Graves, where the cultural operations are done by hand or with teams, the pruning methods do not differ much from those of Médoc.

Vines are simply formed to a height of from 14 to 15 inches, instead of from 6 to 8 inches, and when they become old they often reach 20 to 24 inches. Each branch carries two arms, formed like a "V," each arm carrying a long rod fastened to a stake 5 to 6½ feet in length (Fig. 43), the young shoots being also fastened to the stake (Fig. 44).

Two systems obtain in vineyards cultivated with ploughs: 1st, the rods may be fixed to stakes, as is the case when the vineyard is worked by hand, or on wires at a greater height than in Médoc; 2nd, they may be fastened on wires (as is the case in that region) or laths 12 to 16 inches high.

In the Palus the vines are generally much more vigorous, and carry three arms, with one or more long rods on each arm (Fig. 45). Two of the rods extend horizontally, fastened to a stake 6½ to 10 feet in height. A third stake placed in the centre supports the trunk and sometimes the third rod.

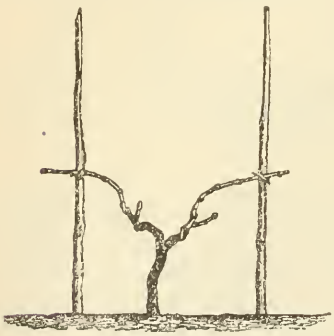


Fig. 43.
Graves vine after pruning (after Foëx).

At Sauternes spaliers are formed with two arms, and sometimes three or four, disposed like a fan in a single plane, each arm carrying one spur of two or three eyes and no rods.

Each crown is from 8 to 12 inches above the level of the soil, and a long stake 6½ to 8 feet in length supports the growth of the year (Fig. 46). The stakes are sometimes replaced by horizontal lines of wires, one at 2 feet, the other at 4ft. 3in. above the ground.

At Saint-Emilion vines are trained rather differently. The two or three first years (Fig. 47) one single spur of three eyes is retained

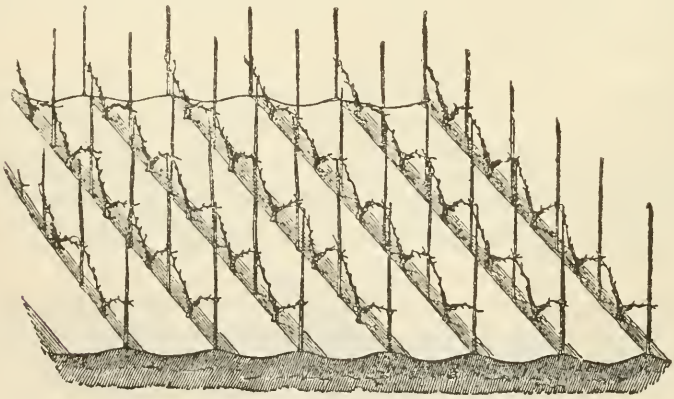


Fig. 44.—Graves vines near Bordeaux (after Foëx).

and fastened to a stake; it is only after the fourth or fifth year that the crown is formed at from 10 to 12 inches above the surface of the soil. This crown carries three arms with spurs, or two or three long rods without spurs, according to the variety cultivated.

Formerly the vines in Saint-Emilion had a single trunk, surmounted by a single rod with or without replacement spurs. Figs. 48 and 49 show the most common types.

Fig. 49 shows the disposition with a replacement spur of two eyes; it is evidently the best, as it allows more development, and especially as it gives two shoots, the lowest of which can be selected at the following pruning season for a replacement spur, the highest forming the long rod. The old rod is thus completely done away with, and the head of the plant only rises very slightly every year.

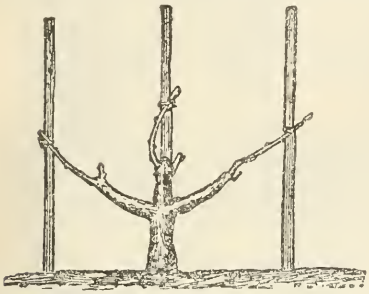


Fig. 45.—Palus vine.

When these vines are trained without a replacing spur, a new long rod has to be taken on the old one, so that, after ten or fifteen years of this pruning, the trunk reaches 3 feet in height, and sometimes more (Fig 50). and it has to be cut back above the sucker which has been retained the year before. We must draw attention to the fact that vines

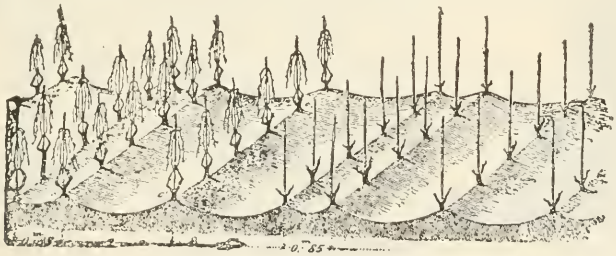


Fig. 46.—Staked vines at Sauternes (after Dr. Guyot).

trained with a certain number of long rods, accompanied by replacing spurs, not only rise very slowly every year, but, further, are

Fig. 47.
Young vine in St. Emilion.

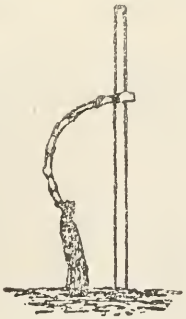


Fig. 48.

Fig. 49.
Old vines in St Emilion.

not subject to those malformations generally noticeable on trained vines with one single long rod. And this is why the general tendency is now to give greater development to the vine by leaving several arms with rods and spurs (Fig. 51).

The vineyards of Gironde offer an example of an intelligent association of long and short pruning. In Médoc, Graves, Palus, and Côtes the ruling method is that which combines the rod and spur.

The system in which vines are trained symmetrically and horizontally on both sides of the stump is difficult to maintain equal, as the sap often flows more towards the one arm than the other, one arm becoming stronger and the other weaker. This is why the vignerons of Médoc find great difficulty in maintaining the two arms of their vines perfectly equal.

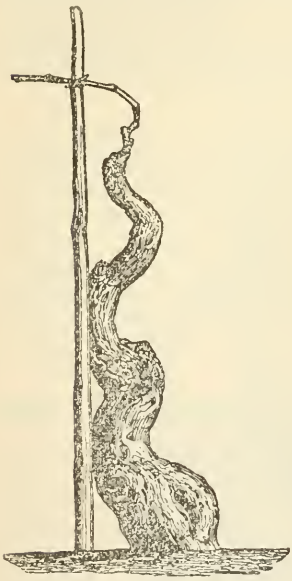


Fig. 50.
Vine pruned after the old system in St. Emilion (after Foëx).

This difficulty would be lessened if the vines reached large dimensions, as in Isere and Savoie; but, when they are trained low, the sap has a tendency to rush more on one side than the other

The spalier, trained on stakes or wires, adopted in Gironde, answers perfectly well the special conditions of its climate. It allows free aeration, necessary in such a damp district, and, further, the grapes, well exposed to the action of the solar rays, ripen evenly.

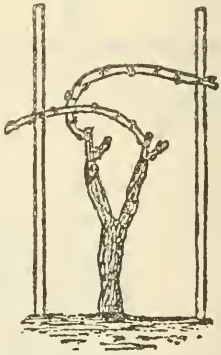


Fig. 51.
Vine pruned after the new system in St. Emilion.

To sum up, the vineyards of Gironde are trained on the spalier system, with long rods, generally accompanied by replacing spurs.

VII.—Pruning in the Pyrenees.

The Pyrénéen region forms a group of vineyards fairly well characterised as a whole by climate, methods of culture, and cépages.

The northern part of this region, situated on the northern side of the Pyrénées ranges, is the coldest. It is exposed to intense cold in winter and frosts in spring; hail is of frequent occurrence, and often causes great damage. Except in rare situations where the temperature is warm and constant, a few special varieties only can be cultivated—hose of the north and centre of France. Gironde impressed its characters on all this vast viticultural country, and its general methods only differ in special points of detail.

The damage caused by hail and frost greatly restricted the planting of vines in the northern part of the Pyrénées, where the most diverse and curious systems are applied side by side. Vines trained with low crowns, without stakes, vines trellised on the spalier system with stakes at a height of 2 feet to 4 feet from the soil, and vines growing on trees from 6 feet to 16 feet in height are to be found there.

The highest vines are found in the southern part which is the highest in altitude and the coldest, and where spring frosts are always to be feared; this accounts for the height given to vines. We will follow the geographical order, and begin with the département of Ariège, that is to say, the south-east region.

Fig. 52.
Vine of Pamiers after pruning.

Ariège has its coldest climate near the Pyrénées, while near Aude and Haute-Garonne it becomes milder.

In the parish of Pamiers vines are cultivated as in Aude, but as we get closer to Foix, low-staked vines become scarce, and we see in most vineyards the rod system applied.

Figs. 52 and 53 show a Pamiers vine before and after pruning. each arm carries a spur of one eye; this system is much too short, and induces rank growth all over the old wood, exhausting the plant.

Fig. 54 gives an idea of a vine at Foix after pruning. We see the vines trellised at a height varying from 20 inches to 6 feet above the

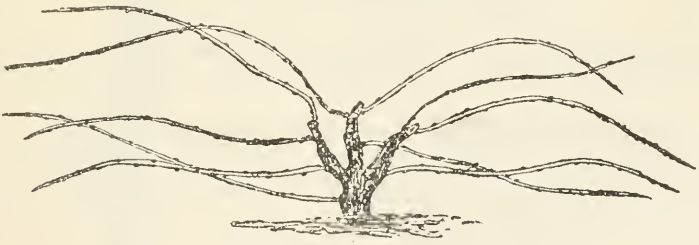


Fig. 53 —Vine of Pamiers before pruning.

soil, the highest being in low, damp, and cold ground, and the lowest on hills or ranges where spring frosts are not to be feared. The frames of these trellises are formed of vertical posts, joined at the top by laths; these laths serve to keep the arms of the vines

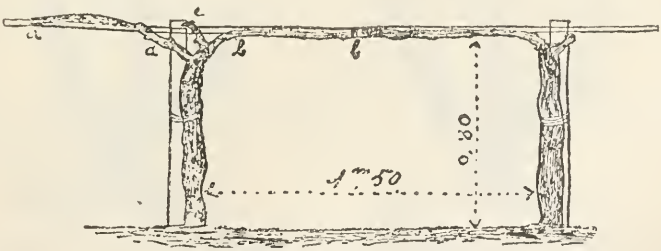


Fig. 54.—Vines in Foix after pruning

in position. Each vine is also fastened to a stake. At the beginning of the pruning season two rods *aa, bb,* from 20 inches to 3ft. 3in. in length, are left, together with a single spur *c*. This is a fault; one should always leave as many replacing spurs as there are rods. The vignerons of this district take too long to definitely establish their vines. It takes from ten to twelve years for a vine to reach the required height, whereas the same thing could be done in from four to six years, according to the vigour of the plant. Further, fruit rods alone are left until the vine reaches its proper height, the replacing spur being left only when the vine is completely formed.

This system might be modified with advantage by forming plants

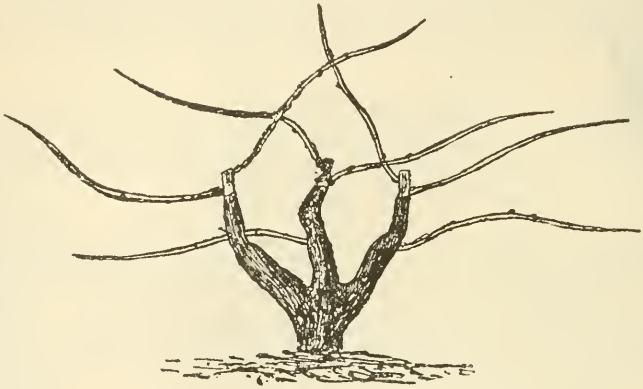


Fig. 55.—Vine in Haute-Garonne before pruning.

with one single rod as soon as their vigour allows it, and by forming from the very beginning a long rod and a replacing spur.

The département of Haute-Garonne is much more important from a viticultural point of view. The system adopted there is very similar to that of Aude and Hérault. The stumps are low with arms

Fig. 56.—After fall pruning.

Fig. 57.—After complete pruning.

and spurs without stakes, but the arms, generally numbering three, affect the shape of a fan in the direction of the lines (Fig. 55). This is to enable the ploughmen to get closer to the vines. On the other hand, the planting is done in lines generally 6 feet distant, the vines being from 3ft. 3in. to 3ft. 10in apart.

No actual pruning is done the second year, the young shoots being simply cut back. The third and fourth years the fan is shaped with two, three, or four arms 4 inches to 6 inches above the soil.

The pruning is done in two operations. During winter the preparatory pruning is done, leaving only one cane on each arm (Fig. 56), and in March or April* the final pruning takes place which consists in cutting back the selected cane with a secateur (Fig. 57).

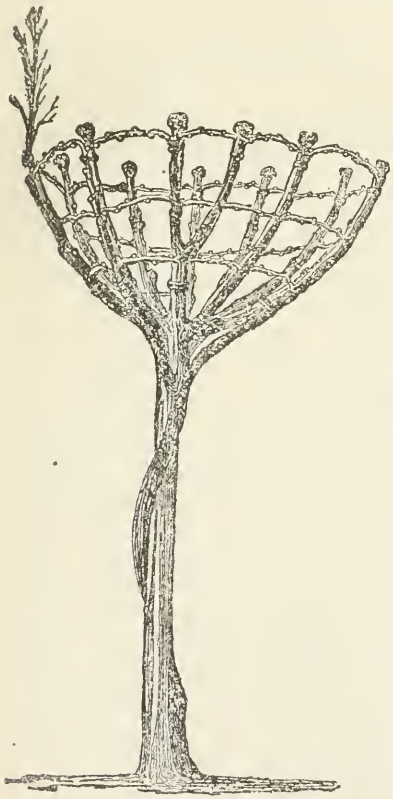


Fig. 58.
Method of training vines at St. Gaudens (after Dr. Guyot).

Formerly near Saint-Gaudens vines were cultivated in a totally different way. Planted at the foot of trees, they were allowed to climb to from 10 feet to 16 feet high, forming a veritable orchard. The trees upon which they climbed had the shape of a reversed cone at the required height, and every year the young shoots of each tree were cut back, except one which was left to preserve the vitality of the tree. The Maple tree was preferred for this kind of culture (Fig. 58).

In some cases the tree and vine were planted together; when the tree had reached a sufficient height, it was definitely shaped with five or six branches, and then the vine, which had been kept low during ten years, was allowed to shoot up with as many arms as there were branches left on the tree. One or two long rods were left on each arm, and after the twelfth year each tree would produce an average of 22 lbs. to 33 lbs. of grapes each season.

This method of training vines on trees has been generally abandoned, and the low-crown system has been substituted for it, as it offers many advantages.

*September or October in Victoria.

THE DEVELOPMENT OF THE FRUIT EXPORT TRADE.

By J. M. Sinclair.

Last year, when visiting Victoria, I had an opportunity of addressing the members of some of the principal Fruit Growers' Associations and giving them some information regarding the British market and its requirements, based on my experience and investigations of the trade in Great Britain. Some of this information may be furnished again in this paper as it has been further verified and confirmed by the past season's results.

The enormons proportions of the import trade of fruit from foreign countries into Great Britain will be given, and it will be seen that although the area placed under fruit trees in Victoria is extending from year to year, so that fresh fruit is frequently a drug in local markets, hardly paying expenses of production, yet no special efforts have been made to get rid of this surplus by exportation and so secure a fair portion of the supply of the trade. With a comparatively small population in Victoria, the quantity of fruit required for consumption is limited, and is often more than supplied by the quantity now grown, resulting at certain seasons of the year in a glutted market and unremunerative prices to the grower. This applies largely to apples and pears which constitute a very considerable proportion of the general crop. Many varieties grown are, of course, unsuitable for the export trade, yet, on the other hand, large quantities of those specially adapted for the requirements of the London market and able to stand shipment, are held and sold for low prices in Melbourne or provincial markets. Many orchards have been planted without any consideration being given to the requirements of an export trade. It should be the aim of growers, when extending their orchards, to give special attention to this, and to plant only those varieties which have been proved to realise the best prices on the London market. These varieties will be mentioned, although now familiar to leading growers who have been shipping fruit for some years past, and excellent payable prices have invariably been realised from year to year provided the fruit was properly graded, packed, and arrived in London in good condition. That there is a good market at profitable prices for these, prices realised during the past five years furnish proof.

For dessert pears arriving in London during April and May, if they can be carried in good condition, as I feel certain they can if properly dealt with, there is a splendid market, at higher prices than can be realised for the best apples. The market then is practically destitute of supplies, and fancy prices are readily paid for the best varieties, as I will indicate when referring to results of shipments.

For grapes arriving in London in the months referred to, there is an excellent market at what the Victorian grower would regard as payable

prices. Proof has been furnished from time to time by the arrival of certain varieties in good condition from Adelaide and Melbourne, that it is possible to ship and land these in good order in London, by refrigeration. In regard to pears and grapes especially, it is absolutely necessary when packing and afterwards in transportation of cases containing these from the orchard to the ship's chambers, including stowage on the latter, that none of the fruit shall become bruised or damaged, and that the utmost care is taken in handling them.

Apples.

With reference to apples the prices realised for the leading varieties arriving in London in good condition may be given. These will furnish a guide to the favorite varieties readily commanding a a remunerative price for the Victorian grower. The last five years prices are furnished as follows :—

	s.	d.		s.	d.	
1898.—Cleopatra	13	0	to	18	0	per case.
Jonathan	12	0	,,	16	0	,,
Esopus Spitzenberg ..	12	0	,	17	0	,,
Cox's Orange Pippin ..	12	6	,,	15	0	,,
Scarlet Nonpareil ..	10	0	,,	11	6	,,
Other varieties from	10	0	,,	12	0	,,
1899.—Munro's Favorite ..	14	0	,,	20	0	,,
Cleopatra	14	0	,,	19	6	,,
Jonathan	13	0	,,	18	0	,,
Esopus Spitzenberg ..	13	0	,,	17	6	,,
Bismarck	12	0	,,	15	6	,,
Five Crown ..	10	0	,,	17	6	,,
Rymer	12	0	,,	14	6	,,
Stone Pippin ..	10	0	,,	14	6	,,
Ben Davis	12	0	,,	14	0	,,
Scarlet Pearmain ..	12	0	,,	14	0	,,
Alfriston	11	0	,,	14	6	,,
Other varieties ..	10	0	,,	12	0	,,
1900.—Cleopatra	13	0	,,	20	0	,, (some South Australian 27s.)
Munro's Favorite ..	12	0	,,	17	0	,,
Jonathan	12	0	,,	21	0	,,
Esopus Spitzenberg ..	12	0	,,	16	0	,,
Rome Beauty ..	10	0	,,	14	0	,,
Bismarck	8	6	,,	12	0	,,
R. de Canada and other varieties	7	6	,,	12	0	,,
A small lot of Cleopatra in last steamer of season 10s.						
1901.—Jonathan	10	0	to	19	0	per case
Munro's Favorite ..	12	0	,,	17	6	,,
Cleopatra	10	6	,,	17	0	,,
Five Crown	11	0	,,	17	6	,,
Dumelow's Seedling ..	11	0	,,	14	0	,,
Rome Beauty ..	11	0	,,	13	0	,,
Other varieties ..	9	0	,,	12	0	,,
1902.—Jonathan	10	0	,,	19	0	,,
Cleopatra	10	0	,,	17	6	,,
Esopus Spitzenberg ..	—		,,	16	0	,,
Munro's Favorite ..	13	0	,,	18	6	,,
Five Crown	10	0	,,	15	6	,,
Dumelow's Seedling ..	12	0	,,	14	0	,,
King of Pippins ..	10	0	,,	13	6	,,
Hoover	—		,,	14	0	,,
Stone Pippin ..	10	0	,,	13	0	,,
Annie Elizabeth ..	—		,,	14	0	,,
Newtown Pippin ..	13	0	,,	15	0	,,
Other varieties ..	8	3	,,	10	0	

From the results of sales of Victorian and South Australian apples for the past seven years at Covent Garden, it has been shown conclusively that the four best varieties for the London market are Cleopatra or New York Pippin, Munro's Favorite or Dunn's Seedling, Jonathan and Esopus Spitzenberg. The latter would command higher prices if they could arrive before the middle of May. After these come Wellingtons or Dumelow's Seedling, Cox's Orange Pippin, Five Crown, Rome Beauty and Newtown Pippin. The latter is one of the highest priced apples exported from the States or Canada. The Baldwin is also a good apple.

Owing to the cold summer, prices of apples ruled lower during the season 1902, than was anticipated. It is always desirable that all Victorian shipments of apples, pears or grapes should arrive before the beginning of June as French cherries then commence to arrive, and prices of the former are immediately affected, the demand for them also diminishing.

The lower prices ruling for Tasmanian and Australian apples during May, last year, caused a wide distribution of them through provincial cities. Tasmanian shipments to Liverpool direct enabled supplies to be distributed through Northern cities.

With regard to temperature during ocean transit 45 degrees should not be exceeded for apples, the best results having been obtained at 40 to 42 degrees.

Pears and Grapes.

From time to time during the past six years quantities of pears have been forwarded, the cases, notwithstanding repeated suggestions made, being stowed indiscriminately among the apples carried in the ship's chambers. The result being if the temperature was not low and receiving little or no air circulation, the pears were either partially or altogether rotten on arrival. Those which were landed in good condition, as I mentioned repeatedly in my reports, were stowed near the air trunks at the sides of the chamber, where they had a cooler temperature, often 37 degrees or 38 degrees, and could not be heated and over-ripen and decay. Instances were given of the excellent prices realised for good varieties of dessert pears when a few cases arrived sound in this way. In 1899, Vicar of Winkfield and Williams' Bon Chrêtien sold for 19s. 6d. and 24s. 6d. per case, and Clairgeau up to 32s. 6d. per case.

The "Gulf of Siam" pears carried under the Sutherland process, with the exception of a few cases, arrived in good condition, although the consignment by the "Gulf of Bothnia" previously was a failure. The varieties were Vicar of Winkfield, Clairgeau, Josephine, Napoleon, St. Germain and Kieffer's Hybrid. These sold at auction realised from 15s. to 38s. per case. From time to time cases of pears from Adelaide, which happened to arrive in good condition, have made similar prices to Victorian. During the past season Winter Nelis realised up to 22s. per case, Vicars from 12s. to 18s 6d., and one case of St. Germains sold for 30s.

I reported on several occasions the success attending the carriage of pears packed in shallow cases or trays, which I regard as the ideal package for them in preference to the ordinary apple box. The instance of a Tasmanian consignment of 420 trays of pears ex *Medic* sent in this way may be repeated. The pears—twelve varieties—were packed in shallow cases containing only one layer of fruit. After packing and the cases closed, three were placed together, and held in this way by cleats nailed on the sides. They were shipped in this manner and arrived in perfect condition. Each tray or shallow case would not contain half an ordinary case of fruit, so that the prices realised as indicated would be very profitable to the shippers.—

306	trays	Bon Cure	7	3		
6	,,	Bosc	20	0		
2	,,	Anjou	12	6		
7	,,	Autumn Bergamot	14	0		
21	,,	Clairgeau	10	0	10	6
55	,,	Chaumontel	9	3		
1	,,	Capiaumont	9	9		
1	,,	Glou Morceau	14	0		
7	,,	Giblin's Seedling	—			
8	,,	Magnifique	10	6		

Both from Adelaide and Tasmania previous consignments of pears sent in these shallow cases arrived in good condition. Packed in this way, and placed on board ship sound and unblemished, and carried at a temperature of from 36 deg. to 40 deg., I am satisfied that the finest dessert pears grown in Victoria can be landed in London in sound condition, and realise profitable prices for growers. If sufficient consignments were forwarded it would be possible to have a portion of the chamber bulk-headed off so as to carry the fruit at a lower temperature than the apples if necessary.

The class of shallow case referred to has also proved to be a suitable package for grapes, a single layer of bunches packed in cork-dust being placed on them. This has been proved by some small consignments sent from Adelaide, and an occasional few cases from Victoria. The temperature should be the same as that required for pears, and the two fruits could be sent in the same chamber. By adopting this system a good outlet for pears and grapes at profitable prices to growers could be developed and eventually it is possible very considerable shipments might be made. The varieties of grapes generally shipped from Victoria are Doradillo and Raisin des Dames. From Adelaide a variety called White Daria is frequently sent. Spain ships enormous quantities of grapes to Great Britain of the Almeria* variety from the end of August to the middle of November. These are in barrels packed in cork-dust.

To ship on a larger scale efforts should be made to secure a reduction on present rate of freights, which are too high altogether. It should be possible to have fruit carried for 3s. per case, and if this were done the shipping companies would benefit by receiving larger shipments.

* We learn that the cuttings of the Almeria and Alicante grapes imported from Spain have struck successfully at the Burnley Horticultural Gardens. Local growers will, no doubt, be pleased to learn this since these two varieties are chiefly used in the Spanish export trade.—Ed. *Journal.*

The Extent of the British Market.

From the following table some information may be gained as to the extent of the requirements of the British market, and the position taken by the various countries supplying it :—

IMPORTS OF APPLES INTO GREAT BRITAIN.

COUNTRY.	1900.	1901.
	CWTS.	CWTS.
Germany	15,665	17,892
Holland	53,264	35,349
Belgium	158,417	148,149
France	63,682	141,785
Portugal	34,427	81,010
Spain	1,316	53,026
United States of America	898,689	726,366
Other Foreign Countries	1,903	2,607
Total from Foreign Countries	1,227,363	1,206,184
Channel Islands	7,962	16,749
South Australia	4,747	12,707
Victoria	3,741	12,816
New South Wales	23	346
Tasmania	79,237	105,497
Canada	803,638	474,712
Other British Possessions	1,830	1,199
Total from British Possessions	901,178	624,026
Total	2,128,541	1,830,210

During the past season the imports from Tasmania amounted to 240,000 cases. The Victorian contribution to the enormous supply of apples required for the United Kingdom is very small. Having an opposite season to the Northern hemisphere Australian shipments do not come into active competition with exports from the States or Canada.

Other fruit to the following value was imported during 1901 :—

Pears,	348,886	cwt.,	valued at	£282,881.
Grapes,	679,885	,,	,,	£694,942.
Oranges,	5,251,832	,,	,,	£2,091,985.
Lemons,	1,071,534	,,	,,	£434,514.

The countries contributing the chief supplies of these fruits were as follows :—

Oranges from Spain	to the value of	£1,847,292.
Grapes from Spain	,,	£523,233.
Pears from France	,,	£194,154.
Pears from United States	,,	£45,847.
Lemons from Italy	,,	£362,007.
Canned and Preserved Fruit from California	,,	£312,687.

These figures will give an idea of the sum of money paid by the British consumer to foreign countries for fruit imported, much of which it is possible to supply from Victoria.

COLD STORAGE FOR THE LOCAL FRUIT TRADE.

By G. H. Robinson.

Though there has been a considerable development during the past decade in the application of refrigeration to the preservation of fruit for transit in a fresh state to oversea markets, little has been done to adapt the system to local needs. For this the fact that many varieties of apples and pears keep fairly well, and for a considerable time when stored at ordinary temperatures is partly accountable, and the wide range of fruits, covering an extensive season, that can be successfully grown in the Commonwealth has not been without influence in the same direction. The comparatively limited amount of space available in the cool stores, and the practically prohibitive figure asked for the accommodation has furthered hampered progress. As a consequence, growers have been content to look almost exclusively to the expansion of the export trade to relieve the pressure of glutted markets in periods of plenty, though a little consideration will show that there are opportunities in the application of cold storage to the local fruit trade awaiting those bold enough to take advantage of them.

Perhaps no fruit is more generally relished than the Williams or Bartlett pear, yet, in an ordinary season, when the supply is at its height, the prices obtainable by the grower are not all that he would desire. In this line it should pay handsomely to store for a month or so, for the fruit, if picked at the right time, can be held in good condition for at least six weeks. It may be objected that the small measure of success that has attended the efforts made to ship this variety to London contradicts this view, but it must be remembered that the conditions are by no means similar, the extra handling, the absence of any check on the temperature, and the constant vibration on shipboard, are factors influencing the result in no small degree, and which have no place in storage on shore. The experience gained in America furnishes us with a more reliable guide in estimating the possibilities. In Western New York single houses have held at one time no less than 25,000 barrels, and in the city of New York alone, as many as 40,000 barrels may be in store at once. The greatest portion of this supply is held for a short time only, but it is by no means unusual to retain the fruit for periods of from six to eight weeks, and, indeed, in trade language the life of a Bartlett in cold store is reckoned at about eight weeks.

Many of the larger canneries in the States have, of late years, been equipped with refrigerating appliances, in order to extend the packing season, and to keep the fruit in a first-class and firm condition. Little, if anything, has been done locally in this direction, but it is interesting to note that certain of our factories have recently been considering the advisability of making similar provision, and there is a prospect that some of our canneries will shortly be equipped with this useful

aid to the manufacture of a high-class article. The greatest difficulty, perhaps, that the canner of soft fruits has to face is to secure sufficient ripeness to meet the public taste without converting his goods into a mush, and in the hot weather this is a practical impossibility, since the fruit softens without coloring properly and without the production of the needful amount of sugar. These difficulties have been overcome in a large measure by the American factories, and the provision of cool storage facilities by local firms, if commercially practicable, would prove of great value to the grower as well as the manufacturer, since the improvement in the quality of the article turned out would lead to an increase in the demand.

The difference in the seasons between Australia and the old world which has led to the development of the apple export trade places any project for the cold storage of this fruit, for the local market, on a basis quite distinct from that which obtains in America, yet some idea of the magnitude of the business in that country may not be without interest. In the *Year Book of the United States Department of Agriculture* for 1900, the origin and development of refrigeration as applied to the fruit industry is traced. From this it appears that it was not until 1889 that the first store, devoted mainly to fruit, was opened for business in Chicago, and the success that followed the earliest efforts resulted in the rapid utilization of the then existing facilities in other centres, and the provision of an enormous amount of new accommodation, so that in 1900 the cool storage space available for fruit was estimated at 150,000,000 cubic feet. Stores have been built wherever there was any reasonable prospect of financial success, and those centres where apple production was a staple industry were soon well equipped. An estimate made early in 1901 showed that at that date there were no fewer than 600 establishments for the cold storage of fruit and vegetables. Of the soft summer fruits, such as peaches, plums, early pears, raspberries and strawberries, only relatively small quantities are held, and then, but for a limited period, as they deteriorate rapidly in quality and flavour even when they retain their appearance. Pears, beginning with the Bartlett, are largely stored and the quantity held of the later sorts is also considerable. The favourites for the purpose are Anjou, Angoulême, Bosc, Clairgeau, Winter Nelis, and Easter Beurré, and these are kept until the spring. But it is in regard to apples that the greatest advantages have been reaped by the grower and the consumer, and among the causes that have led to this result are the preference for this fruit exhibited by most people, and the fact that apples retain their condition and flavour better than any other fruit. This trade has indeed assumed so much importance that statistics are collected as a guide to dealers showing the amount of fruit held in store on certain dates. The figures given below, furnished by the officials of the National Apple Shippers' Association, will show the magnitude of the business.

ESTIMATED QUANTITY OF APPLES IN COMMON AND COLD STORAGE, 1898-1900 INCLUSIVE.

YEAR.	COMMON STORAGE. BARRELS.	COLD STORAGE. BARRELS.
December 1, 1898 ..	400,000	800,000
December 1, 1899 ..	634,500	1,518,750
December 1, 1900 ..	792,000	1,225,000

This system of storage in America has produced much the same result on apple growing as the export trade in this country. At the time when supplies are heaviest large quantities are withdrawn from sale, and in this way the price of good, sound fruit has been appreciably raised, a distinct advantage from the point of view of the grower, and the supply spread over a much longer period to the benefit of the consumer.

The extent of the benefits that may be reaped here remains to be seen, but there can be no doubt but that there is a very good opening for the adoption of similar methods. In the local market, from July to September, good varieties of apples, in sound and attractive condition always command a high figure, almost, if not quite as good as the average obtainable in London. It is recognised, of course, that the market is not so extensive, but that is not a sufficient reason for total neglect. If it pays the Californian grower to ship apples and pears to arrive in Sydney and Melbourne in the early spring it would surely pay local men to store. The charge at the Government Freezing Works is 2d per case for the first week, and 1½d. per week thereafter, so that for fruit placed in store in the middle of March the cost would amount to 2s. 3d. by the middle of July. A system of packing less expensive than is required for the export trade could, with safety, be adopted, though the use of the ordinary export case might be advisable on account of the saving of space. It would seem then, that the only requisite to ensure the development of a business of considerable magnitude is the provision of adequate accommodation in cool stores, and the great waste that now takes place in storing at ordinary temperatures would be largely avoided.

THE CODLIN MOTH.

By James Lang.

(*A Paper read before the Annual Meeting of the Central Fruitgrowers' Association, September 1902.*)

How Many Broods in a Year?

During the past two years there has been an abnormal increase in the numbers of the Codlin moth, from all parts of the State fruitgrowers complain of its ravages. In the Harcourt district with an altitude of 1,300 feet, we used to have only one brood in the year; but during the past two years, owing, I think, to the very dry seasons we have experienced, quite a new departure, as far as this district is concerned, has taken place in the habits of the Codlin moth. I have maintained for many years past, that there was only one brood during the season; but, from my experience during the past two years, I have been forced to the conclusion that there are at least two, if not three broods in the year. On the 12th. December, 1901, when examining the bandages on the apple trees, I found that several grubs had passed into the chrysalis stage, and in the course of a few days would have emerged as fully developed moths. This was the first time I found the chrysalis in the bandages so early in the season. During the summer the bandages were examined every week, and on each examination chrysalids were found. When taking off the bandages towards the end of April I found some moths flying about, and, as the moths make their appearance during the latter part of September, this shows that they were about in the orchard for a period of eight months, last autumn being abnormally hot and dry may account for their appearance so late in the season.

Last year I stored all the empty fruit cases that had been used in the orchard during the season in the empty fruit room, and kept the doors closed from the first of September, and towards the end of the month I caught the first moths on the windows. During October the number of moths increased every week until the first and second week in November, when the greatest number of moths were caught, after that they decreased until the second week in December, when no more were seen. The moths generally made their appearance on the window during the afternoon, from 2 o'clock to 6 o'clock p.m., very few during the night or early morning. I also noticed that if the weather was at all cold very few moths appeared; while on a warm day a large number used to hatch out. From these observations it will be seen that the first brood of grubs took nearly three months before they were all hatched out, and as the second brood began to appear during the third week in December, the supply of moths was thus continuous right through the summer. As the later broods do far more damage to the fruit than the first, it shows the necessity of growers using all

possible means of destroying the first brood, especially when it is known that every pair of moths lay up to eighty eggs, the importance of destroying the first brood is apparent.

Preventive Measures.

It is very important that orchards should be kept clean, no litter or rubbish of any kind lying about that will give harbour to the grub. All loose bark on the trees should be scraped off and burnt, and any holes that could shelter the grubs filled up with putty, so as to lessen their hiding places. Props that may have been used to support the branches should be carefully looked over, and all grubs destroyed, the broken ends of branches should be neatly cut off, and, if these suggestions are carefully carried out, the first brood of moths will be materially reduced. Returned empty fruit cases are a fruitful source of infection. All growers should have a large boiler on their premises, so that cases may be scalded before being taken into the orchard. It is very satisfactory to know that the Department of Agriculture is constructing two dips in Melbourne in connection with the markets, where all empty cases can be disinfected before being taken home, or consigned up country by rail. Bandages should be placed on all the trees early in November, in a mixed orchard it is advisable that every tree should be bandaged, as the grubs sometimes crawl along the ground for a considerable distance before finding a place to harbour. Bandages should be examined every week, and grubs destroyed. This should not by any means be neglected, especially during warm weather, because the grub, when it leaves the apple, soon enters the chrysalis state and emerges as the moth in a few days ready to lay her eggs.

The fallen apples should be picked up every day and scalded or destroyed.

Spraying.

Spraying for the destruction of the moth is, perhaps, the best method of dealing with the pest. The first spraying should be given about the middle of October when the petals fall, for then the calyx cup of the young fruit is open and ready to receive the poison. The spraying should therefore be done before the closing of the calyx, and should be repeated every fourteen days till the end of December. Paris Green and White Arsenic are the most effective remedies with which to spray. 1 lb. Paris Green and 6 lbs. lime to 160 gallons of water is the strength I have been using for some years. The method of preparation is to place 8 ozs. Paris Green in a tin or jar with a little lime water, just sufficient to make it into a paste, then add more lime water to thin it down, put 3 lbs. lime in a tub and add a little water to slake it, when slaked add more water to make 12 gallons, strain this through a thin piece of bagging into the pump cask, then add the Paris Green, stir well and make up to 80 gallons with water. I have a small tin which just holds when full 8 ozs. Paris Green, this is quicker than weighing out each time and is just as exact.

A good sample of Paris Green should contain :—

Copper Oxide	31·29
Arsenious Acid	58.65
Acetic Acid	10·06

Arsenate of Soda is made according to the formula of Professor Kedzie, of America. Place 1 lb. of White Arsenic and 2 lbs. of Washing Soda in a gallon of water, and boil until the contents go into solution, which is almost colourless. This is used at the rate of 2 pints to 80 gallons of water and lime water added in the same way as for Paris Green, and makes up to 80 gallons. These two mixtures are about the same strength.

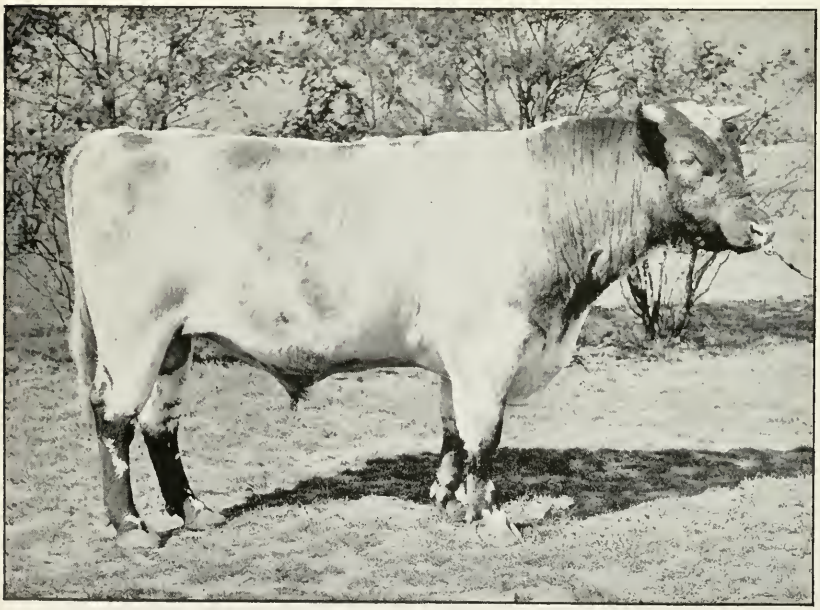
The Arsenate of Soda spray gives rather better results than the Paris Green ; this was brought out very clearly in a series of spraying experiments by Mr. G. Quinn, Fruit Inspector, South Australia. In spraying with Paris Green it is necessary that the mixture should be constantly agitated to prevent settling, growers should therefore see that their pump is fitted with an efficient agitator.

In applying the spray do not drench your trees until the liquid drops from the leaves, as little good is done in that way, rather just spray sufficient to damp the trees all over with a fine mist, and leave off before the leaves begin to drip. The lime used should be perfectly fresh, otherwise it is of no use.

BEAUTY III

UNION JACK.

SPICY PEER.



SCOTTISH BEAN.

SUNSHINE I.

DALMENY NONPAREIL VII.

IMPORTED SHORTHORN CATTLE.

By J. R. Weir.

A notable shipment of shorthorn cattle, comprising six cows and three bulls, recently arrived from the old country to the order of Mr. Jas. McLaughlin, of Mahonga station. Advantage was taken of the presence of the animals at the quarantine station to secure the photographs reproduced in this issue, and a few particulars are also given of their breeding.

Sunshine I.

This roan heifer was born on Federation Day, 1st January, 1900, and bred by the Duke of Richmond. Her sire was Village Archer (71789), and dam Sunshine, by Musgrave (64470). Mr. Duthie, the breeder of Village Archer, refused 300 guineas for him last spring, when the same amount was accepted for his brother.

Union Jack.

A rich red bull, calved on 19th December, 1900, by Prince of Fortune (77494), who gained second prize to Choice Goods at the Aberdeen Show in 1900, the only occasion when he competed. His dam, Duchess 37th, was by Musgrave (64470), bred by Mr. Marr.

Spicy Peer.

This typical shorthorn gained second prize at Royal Northern, Aberdeen in 1901, and first and champion at Buchan Agricultural Show, Mintlaw. His sire, Spicy Robin, was first pick of Mr. Willis' 1895 calves, and was bought at the high price of 250 guineas when twelve months old. His dam, Alexandrina 24th, is daughter of that famous cow Alexandrina 20th, full sister to Gay Monarch, winner of sixteen first prizes in one season in America, and also winner of the herd championship with four of his get over all breeds at the World's Fair, Chicago, 1893.

Beauty III.

A beautiful rich red roan heifer, which gained first prize at the Royal Northern Show, Aberdeen, in 1901, and second, as a yearling, at the Buchan Agricultural Show, Mintlaw. Sired by His Grace (74705), dam Beauty, by Hartington (68762).

Dalmeny Nonpareil VII.

A fine roan heifer by Scottish Sailor (73594) out of Nonpareil Pride, by Gravesend (46461). She secured first prize at Edinburgh in June, 1901, and her dam, though now fourteen years old, is still a regular breeder, and is out of the same dam as Statesman, the champion bull of Canada and U.S.A. in 1873.

Scottish Bean.

This fine roan bull has only once been exhibited, and on that occasion—at Aberdeen, in 1901—he gained first prize in a class of 150. His sire is Leopold (74836), and dam Superb Blossom, by Superb (64902).

THE GELDING OR EMASCULATION OF COLTS.

By David Wilson.

In travelling through Victoria I have found that many farmers when they have colts to be gelded look upon the operation as a matter of anxiety, because they are afraid of abnormal swelling, or perhaps, death taking place. Under the old system of castration, and searing, there is no doubt that horse-owners had grounds to be anxious about results, but I do not think that the searing-iron was the sole cause, unless unskillfully used. In my opinion, the blame, very often, rested with the horse-owners themselves, because, as a general rule, they did not give the colts any preparation before the operation. The animals were brought straight out of the paddocks, thrown, and castrated, when their stomachs were full of food; in that condition they consequently hurt themselves by straining, became sick and distressed, and that was the main reason why the results in many instances were not satisfactory.

It has been proved, in Victoria, during the past year that searing the arteries is quite unnecessary. In unskilful hands the searing iron is an implement of torture, and, even when used with judgment, is a severe shock to the nervous system of the animal, causing unnecessary distress. The system of emasculation without searing is in general use in America; all the gelding of domestic animals, horses, cattle, rams, dogs and cats is done with the emasculator without searing. During the past year I have, by request of the various Agricultural Societies under whose auspices I have been working, given a series of practical exhibitions of castrating colts and stallions without searing. 134 exhibitions have been given, 410 colts, including 40 stallions, have been gelded; the instruments used being "Kendall's Emasculator" and the "American Emasculator." All the stallions were operated on with "Kendall's" instrument, as I consider it the safest for them. The results have been very satisfactory indeed, the animals showing little distress, and in only a few cases has any swelling occurred; the owners express great satisfaction with the method.

The Preparation of the Subjects.

For colts in ordinary health and condition all that is required is to have them empty of food, they must be kept in a bare paddock, or yard, without food all night before being operated on, and be turned out into their usual paddock when gelded. Stallions, especially if stabled-fed, should be reduced in condition, and prepared for several days before the operation, by giving them bran mashes, greenstuff, or other laxatives, and also get them used to being turned out at nights. The best time of the year to geld them is when they are out of season, during mild weather in the autumn or winter. They should be empty of food when operated on, and when gelded turn them out into a

METHOD OF TYING COLTS FOR CASTRATION.

paddock, rugged if necessary. If a paddock is not available, a roomy clean loose box, that has been well disinfected, will do, and exercise should be given next day.

The opinions of horse owners vary greatly regarding the best age to geld colts. I think that the best and safest time to castrate ordinary colts is in the autumn—before they are weaned. At this age the operation does not check their condition or growth, and I am convinced by experience that if gelded young, they make quite as good horses; some of the best horses, both for pluck and staying powers, that I have seen were castrated when from six to nine months of age. If colts are left till over twelve months old or till their generative organs are fully developed, the shock through castration must be more severe, and the alteration made in their system is considerable, besides they very often lose condition when gelded.

Casting the Colt.

One of the handiest ways of casting or throwing wild colts that have to be lassoed is to put a running noose round the two forelegs, let the rope drop down just below the knees of the horse before tightening the noose, then pull straight out from the side, those holding the neck rope at the same time pulling the opposite way; the animal will fall on his side and can easily be held there till tied.

Of the various styles of throwing colts, that with collar and heel-ropes is most in use, and if two hobble straps with one ring on each are put on the hind fetlocks, so that the ropes can run through the rings instead of round the back of the fetlocks, it saves the chafing which often occurs, especially in casting thoroughbreds. As soon as the colt is thrown, straighten out the two forelegs, put a rope round the front fetlocks, and pull straight on the rope keeping the fore-feet off the ground, this will prevent the colt from getting up and will enable you to tie the hind legs in the position shown in the photograph. I find this is a simple, safe and effective way of securing the hind feet, and as the horse is kept on his side, he does not strain or hurt himself, and they can be let up quickly when the operation is over.

In putting on the hind leg-rope the loop is put on the under hind fetlock, the rope is then pulled under the rump and round the back; care must be taken that the under (or near) hind-leg is pulled into the side in a natural position, by turning the colt slightly on to his belly, his own weight will assist in bringing the under leg close in. Put the free end of the rope over the top hind fetlock, using only one half-hitch, pull the leg close to the horse's body, then put one turn of the rope round the fetlock to hold the half-hitch secure. The brand should be put on the shoulder while the forelegs are held straight, the off fore-foot can then be strapped to the arm, and the under fore-leg left free. Keep the colt on his side, and he is ready to operate on.

The Operation Described.

First draw out the penis, and oil it and its sheath with olive oil. Have the emasculator instrument in a bucket of antiseptic. I use one

tablespoonful of Lysol, well mixed with six quarts of clean rain water. Have the bucket of antiseptic solution within reach, at the tail of the colt ; with a clean cloth, dipped in the solution, wash clean the scrotum, or purse, and between the thighs, so that the parts where you will make the incisions will be perfectly clean and sterilised. Wash the hands clean with the solution. Now take notice which testicle is the smallest or most difficult to get, which is usually the off side or uppermost one, take that one first, press the testicle into the purse, grasp it firmly with your left hand, and with your castrating knife make the incision in the purse just large enough for the testicle to pass out, being careful to avoid the scrotal veins when making the incision. Hold the testicle with your left hand, and, without drawing it out any further than is necessary, sever the muscular, or white end with your knife, the testicle is now held by two cords, the red one is the spermatic artery, the white one is known as the *vas deferens*. Pass your finger between the white cord and red one, and sever the white cord with your knife close to where you have cut through the muscular end of the testicle. The colt is now deprived of the power of drawing the testicle back, and it can be left attached to the artery until the other incision is made, and the lower testicle exposed, and the parts severed in the same way.

Use the emasculator on the lower one first, draw the artery just as far as it will come naturally, without straining, put it in the jaws of the instrument, slack the artery a little to allow it to go down into the socket of the lower jaw of the emasculator, and close the instrument slowly and firmly. In using Kendall's I do not pull the testicle off, but run my knife through the artery at the back of the instrument. When the testicle is removed, hold the artery firmly in the instrument for a few seconds, while washing the blood off the exposed end, then open the instrument and let the part go back inside the scrotum; remove the upper testicle in the same way. If the colt struggles while using the emasculator, be careful to keep the instrument close to the horse so that the artery will not get strained by pulling outwards.

With the antiseptic cloth wipe off any blood, and dress the Scrotum or purse and between the thighs of the colt with a mixture of clean Linseed Oil and Lysol of the strength of 1 part Lysol to 20 parts of Oil. Take off the rope and strap and let the colt out of the yard. There will be practically no bleeding or swelling after the operation, and the animals should be put into a paddock so that they can get exercise. The animals as a rule show very little distress and will start feeding almost immediately after the operation.

I hope to see the system of castration without searing become general in Victoria in the near future.

AN INJURIOUS WEED—ST. JOHN'S WORT.

By C. French, F.L.S.

The Area Invaded.

In accordance with the wish of the Hon. the Minister, I visited the districts in which the presence of this weed has been reported so as to obtain from personal observations, with the assistance of municipal returns, some idea of the extent of its spread, the probable number of acres affected, and also to suggest some means of keeping it in check.

The first place visited by me was the Bright district, where the weed has greatly spread since my former visit. From Bright township I went to Harrietville, and up to the Alps (Mt. Hotham), an elevation of over 6,000 feet. I found the weed sparingly along the coach road from Bright to the Hospice, distance about 28 miles. At the rear of the Hospice there is a patch of about an acre in extent, and following down the Grant road patches of the weed were found to extend for some miles, and I learned from Mr. Lawlor, who knows the district well, that it occurs on the Crooked and Dargo rivers some 12 or 15 miles from the Hospice.

From Bright I went to the Kiewa Valley (Tawanga) and in this locality several small patches occur.

Leaving Bright, the weed may be found in fair quantity along the railway line below Myrtleford, and from there through to Beechworth and Yackandandah, some large patches having been found growing between Porepunkah and Happy Valley.

Upon arrival at Beechworth I found the weed to be fairly plentiful in several places, viz., at Mr. Bilson's farm and on the Buckland road, also in small patches near the town.

From Beechworth I went to Wangaratta, but could not find the weed although it is in the Oxley Shire.

At Rutherglen there are some bad patches the worst being probably that in the Public Reserve.

It would not be possible unless a lengthy journey be taken to give the exact boundaries of the spread of this weed, its presence in small patches being reported from Omeo.

From the documents kindly supplied by the Shire Secretaries, the area affected is approximately as under :—

District or Shire.	Government Land Acres.	Private Land Acres.	Total Acres.
Bright	2,660	2,671	5,331
Beechworth	50	466	516
Narong	—	161	161
Carlisle	—	1,821	1,821
Lilliput	—	263	263
Gooramadda	—	257	257
Railway between Bright and Benalla, say ..	200	—	200
Totals..	2,910	5,639	8,549

Suggestions for Checking Its Spread.

Having looked at the matter of expense and convenience connected with the means to be adopted for keeping this weed in check, even if we cannot for the time totally extirpate it, I have come to the following conclusions, such as I trust may commend themselves to those having a practical knowledge of the subject.

Cutting.—This, to prevent seeding, should be done before flowering, and in old workings, this could best be performed with a "bush scythe." On land where some machine could be used the process of cutting would of course be more rapid. After cutting, the rubbish should be burned on the spot or as near to it as possible.

Ploughing. This could only be carried on in fairly level country, although the "Stump Jumper" could be used in many places. The material should be cut and burned before ploughing the land as the roots are not easily killed. The summer, if sufficient ploughing strength be available, would be the best time to tackle it, and the more the land could be ploughed, cross-ploughed, harrowed or otherwise knocked about the better.

Hand-Grubbing.—This work could be performed by a body of men with grubbing-picks, mattocks, or similar tools, as there are large areas amongst the old workings where hand labour would have to be employed.

Many are unaware that simply grubbing up the plant will not eradicate it, as each piece of root, if left in the ground, will take root and eventually form a new plant. This is a very serious matter, if finality in the matter of permanent eradication could not well be assured.

Scrub Exterminators.—Where these could be used it would probably be the cheapest method of dealing with the weed in places where machines would be out of the question, but as arsenic forms the basis of many of these so called scrub exterminators, it would be unsafe to use them near to the watercourses from which the town and district derives its water supply.

Some of the scrub exterminators destroy all vegetation, whilst others permit of the grass growing again in a short time and this as well as the probable cost per acre would have to be ascertained by experiment.

Other Methods.—When growing between the railway lines, the Railway Department might be approached with a view of rendering assistance so far as jurisdiction extended, and contractors making roads through the country might also be induced for some small remuneration to take steps for its destruction at its utmost limits. There is some road-making going on in the Alps now, and the present opportunity should not be lost.

I would compel all travelling cattle to keep to the Grant track, at least until the weed has been cut in the Bright district, and would prohibit chaff or hay grown on infected areas being taken away from

the district. I think that 100 good men with bush scythes would cut the most of the weed within three or four miles of the Bright township in a month, and thus prevent the plant seeding and being carried broadcast over the state. If local labour could be obtained I think it would be more satisfactory as persons resident in the affected districts would be able to work at the weed at a time when not too busy at other farm work, and could I think be depended upon to take more interest in the work than would strangers at even lower wages. I think the latter view of the labour question would also be acceptable to the districts interested.

The Question of Cost.

This is a matter about which I could hardly venture an opinion, for the reason that some acres of the weed could be cleared for a trifle, whilst others may cost five pounds (£5) per acre, and even more to do it. At any rate the Government will have to take the matter in hand, by clearing Crown lands and compelling private owners to do likewise, as I feel certain that the municipalities cannot be depended upon to do much in the matter, and, in the meanwhile, the weed is rapidly taking possession of the country. For a commencement I would beg to recommend that as much of the weed as possible be cut and burned before flowering, this to prevent seeding and consequently a further spread of the trouble mostly by travelling stock. This would be a step in the right direction, and could be accomplished by either the unemployed, supposing any funds were available for the purpose, or by local labour under the supervision of the shire engineer of the districts in which the work is being carried out. If anything is to be done, the start, I consider should be made from the extreme boundary of the affected area, gradually closing in to the centre which would undoubtedly be Bright, as in some places as on the Alps a deal might be done at a small cost, the weed occurring only in light patches and often at distant intervals.

THE BABBLER.

(*Pomatorhinus temporalis, Vigors and Horsfield.*)

(SYN. *Pomatostomus temporalis.*)

By C. French, F.L.S.

The Babbler is commonly but erroneously known locally as the Cat Bird, probably because when a number are gathered together the noises they make bear so striking a resemblance to the mew of a cat, that the stranger hearing them for the first time would naturally conclude that several cats were in the vicinity. This bird is undoubtedly one of the best friends of the orchadist, as it exhibits a striking partiality for the larvae and pupae of the codlin moth. On a visit to Somerville some time ago, Mr. G. Shepherd drew my attention to a number of these birds in an orchard some distance from his nursery. They were very busy climbing up and down the apple and pear trees, hunting in the crevices of the bark and under the bandages for the grubs, and as fully a dozen were engaged in this useful and self-imposed task, their combined efforts would result in a very decided benefit. Incidents such as this are of almost every day occurrence and serve to give some idea of the value of these birds as insect destroyers.

Gould states that "the sexes do not differ in outward appearance, and may thus be described :—

Throat, centre of breast, and a broad stripe over each eye, white; lores and ear-coverts, dark brown; centre of the crown, back, and sides of the neck, greyish-brown, gradually deepening to a very dark brown on the wing-coverts, back, and scapularies; wings very dark-brown with the exception of the inner webs of the primaries, which are rufous for three-fourths of their length from the base; tail-coverts and tail, black, the latter largely tipped with pure white; abdomen and flanks, dark-brown, stained with rusty-red; bill, blackish-olive-brown, except the basal portion of the lower mandible which is greyish-white; irides in the adult straw-yellow, in the young, brown; feet, blackish-brown."

The nests are bulky with the entrance at the side, and are composed of dried sticks or rootlets lined with fur, bark, or other similar material. Unfortunately they are easily detected, and often placed within reach of mischievous little boys. Some I have noticed in small gum trees or she-oaks only a few feet from the ground, where they are easily robbed and many young birds destroyed.

The interesting note made by Mr. Campbell in regard to the habits of these birds, to the effect that several retire to the one nest at night, I am able to confirm from my own observations. On many occasions I have observed several birds to fly from a nest when the inmates were disturbed just about dusk.

"BABBLER."

(*Pomatostomus temporalis*—Vig. and Hors.)

The eggs are of a brownish-grey colour with cobweb-like markings, easily washed off. The clutch usually consists of four or five eggs, but Mr. North states that Mr. Jas. Ramsay once took fourteen from one nest, which he had no doubt were the joint property of several birds. Breeding takes place principally in the months of September, October, and November. Mr. A. J. Campbell and other observers record the existence of the Babbler in Queensland, New South Wales, and South Australia, as well as in Victoria.

TOMATO LEAF SPOT.

(*Septoria lycopersici, Speg.*)

By D. McAlpine.

Early in April last, some badly spotted and unhealthy tomato leaves were forwarded for examination by Inspector Cronin from the Tally Ho district. The general appearance of the diseased leaves is well seen in Fig. 1 of the accompanying plate, reproduced from a photograph by Mr. G. H. Robinson. The plants were grown in a very exposed situation, and probably were somewhat weakened before being subjected to the attacks of the leaf spot fungus.

Though this particular disease has not previously come under my notice in Victoria, very probably it has existed here in a mild form for some time past. Dr. Cobb, of New South Wales, recently mentioned a leaf disease of the tomato as existing in that State, and which is apparently the same as the one we are now dealing with.

The original home of this fungus appears to be Argentina, for the first record of its existence was made on tomatoes there in 1882. In 1888 it was noted in Italy, while in 1894 such a severe outbreak occurred in the United States that the tomato crop was almost entirely destroyed in many districts.

Symptoms and Nature of the Disease.

It causes spots not only on the leaves, but also on the stems and fruits. On the leaves it occurs as large irregular spots, sometimes so numerous as to cover the entire surface, and of a dirty-brown or ashy-grey appearance. The attacked leaves lose their green colour and become languid, either dropping off or withering on the stem. The spots are thickly studded with minute black dots, just visible to the naked eye, and these constitute the fructification of the fungus. The calyx of the flower may also be attacked, and there is a consequent failure to set fruit.

The little black points are the spore cases, one of which is shown in Fig. 2 allowing the spores to escape. The spores are produced in great profusion, and are elongated, slender, rod-like, jointed bodies, of a clear colour, and with granular contents (Fig. 3). On an average, it would take about three hundred of them end to end to make up one inch. The formation of the spore cases is much accelerated in moist and muggy weather, and when the diseased leaves fall to the ground, where they may remain continuously wetted for several days, the production of spores is rapid and profuse.

Treatment.

Spraying, when begun early, has been found effective; but there are other precautions which may be taken so as to render this trouble-

TOMATO LEAF SPOT.

some operation less necessary. The ground chosen should be well drained, and for two years previously no tomatoes should have been grown upon it, so as to make sure that the soil is not saturated with the spores. The plants should be trained on stakes, and any diseased portions should be removed as soon as they appear. Spraying with Bordeaux mixture for this disease has been recommended in American publications, but no opportunity has been afforded here of putting it to the test; since it must be done early, before the disease has made much progress.

At the Alabama Agricultural Experiment Station, Mr. F. S. Earle sprayed the plants with Bordeaux mixture as soon as the disease was observed, and one application was found to check it entirely, so that the plants recovered. The spraying can also be done when the plants are in bloom.

Explanation of Plate.

Fig. 1.—Leaf of tomato attacked by the leaf spot fungus (*Septoria lycopersici*). The dark blotches represent the diseased areas, the whole being slightly reduced in the photograph.

Fig. 2.—Section through a spot on the leaf, showing the fruiting portion or spore case (*perithecium*), embedded in the tissues, and containing numerous sporules. (× 145.)

Fig. 3.—Sporules. (× 500.)

Figs. 2 and 3 from drawings by Mr. C. C. Brittlebank.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. VII.

Nematodes, or Round Worms.

Having dealt in a general way with the tape or ribbon worms possessing jointed bodies, and having pointed out some facts connected with their life histories, we now turn to another great division of animal parasites constituted by round worms whose bodies are not jointed. The round worms, or nematodes, are particularly extensive invaders of the bodies of animals and birds, as well as of ourselves, and they may be found lodging in the cavities and in the tissues of organs of their hosts. They vary much in size. Some may be only a line or two in length, and others several inches long. Some are the cause of the most formidable diseases that can possibly attack man; others, again, cause great mortality amongst the lower animals.

The anatomical characters of the nematodes present the same general features throughout. The sexes are distinct. The female, as a rule, is generally much larger than the male. The mouth is situated at the anterior end, and has surrounding it papillæ, or little nipple-like projections. The mouth is practically a sucker and it is by means of the mouth and papillæ that the worms fasten themselves on to the mucous membranes lining the cavities of the tubes or organs in which they exist. The mouth leads into the intestine, which runs straight through the body. There is a rudimentary nervous system present. In the male worm the generative organs consist of a single coiled tube, and in the female they are much convoluted, and very complex. When impregnated, these organs occupy nearly the whole of the body of the female worm. The eggs, when ripe, escape from the female worm, which may be sojourning in the lungs or intestines of its host, and eventually gain the outside world with the waste products.

Unless damp earth or water is reached by the eggs, they do not generally undergo further development. If exposed in dry situations to the heat of the sun, the life of the eggs is destroyed. Droughts minimise, wet seasons favor, the invasions of animals by parasites. In water or damp earth, the eggs undergo a certain stage of development, and, even perhaps before passing from the bodies of the hosts, a certain stage of development may have been attained. Before any further development can occur the embryos require to make their way into the bodies of certain other creatures known as intermediary hosts, where they will receive both nourishment and protection to escort them a stage on their journey. The intermediary hosts for many of the round worms are grubs, snails, caterpillars, gnats, flies, and molluscs.

Into the bodies of these intermediary hosts the embryos of the round worms find their way, and after passing a certain stage of their existence there, they bore their way out again into the water, or perhaps are swallowed along with their intermediary host by the animal in which nature intended them to become adult. Whether or not some round worms can develop from the egg stage to the adult form without passing through the body of an intermediary host does not necessitate debate; but the fact is incontrovertible that it is from water pools, damp situations, and vegetable foods that animals, man included, become infested with nematodes. Animals browsing over marshy places, or drinking the water of pools in which the ova were deposited, pick up the embryos. Young children become infested from the filthy practice of eating mud, and also by means of water drawn from impure sources. Round worms abound all over the globe. They are denizens of the torrid and frigid zones, and are abundantly scattered over the temperate regions. They are found in the lungs, liver, kidney, heart, muscles, arteries, intestines, glands, eye, skin, &c., of their hosts.

Lung Worms.

Pastoralists and poultry-keepers are particularly interested in the study of the life history and habits of lung worms. It is not uncommon to find them in the respiratory tracts of animals and birds, and man even is not exempt. In the pig a lung worm is encountered, and another is the cause of "hoose" in calves, exciting a hoarse bronchial cough and causing a difficulty in breathing. Imperfect aeration of blood may occur from the blocking up of the air passages by the worms, and this may bring about loss of condition in the calves. In the trachea, or windpipe, of fowls a round worm, the *Sclerostoma syngamus*, is observed, which causes the disease known as "gapes." The eggs from this worm escape from the mouths of the birds, and, if they reach water, or are deposited on damp soils, they undergo a certain stage of development. The embryos next bore their way into the bodies of insects, snails, caterpillars, or molluscs, or perhaps bury themselves in decaying vegetable matter or in the moist soils about water pools. Fowls roaming over damp places pick up the embryos along with their food or water. The embryos find their way from the mouth into the trachea, and there develop to the adult form.

In the sheep, lung worm is particularly common, and may occasion great mortality in lambs. The lung worm of the sheep is the *Strongylus filaria*. In the process of its development it may pass through the bodies of molluscs, snails or caterpillars, and then, after a time, it may bore its way out to again enjoy a brief free existence. It only flourishes in marshy or damp districts, and it is on such country that young lambs, when grazing, pick up the embryos along with their food or water. The embryos, on gaining the mouths of their hosts, may find their way into the windpipe, and thence gain the ramifications of the bronchial tubes. On reaching the lungs, the embryos develop to adult form, and from the lungs the eggs may escape with the secre-

tions. The eggs of the *Strongylus filaria* are frequently hatched in the lungs of sheep, and then extensive inflammation of the respiratory organs may be occasioned. Again, they sometimes lay eggs in masses in the smaller bronchial tubes, and, on section, such lungs present a tubercle-like appearance. I have never yet come across a case of tuberculosis in sheep. I have, however, frequently observed a tubercle-like appearnce, but the microscopic examination has always revealed such cases to be degenerating hydatid cysts or "worm nests."

GENERAL NOTES.

"Special" Manures.

A simple demonstration conveying a useful lesson to the farmer has just been carried out at the new Harper-Adams Agricultural College, Shropshire, England. Seven cwt. of an ordinary compound manure (a "special turnip munure," sold at £6 15s. per ton) was applied to an acre of roots; to a second acre, the same quantity of plant food was given in the form of a mixture of supherphosphate and sulphate of ammonia, followed by a top-dressing of nitrate of soda. The cost of the special manure was 47s. per acre, of the other 27s. 9d. The result, as was anticipated, was an almost equal yield of roots, and a saving on using the home mixed manure of 1s. per acre. This demonstration wants repeating in every country, for there are two classes who have not yet learned to assess "special" manures at their real value—manure manufacturers and farmers.—*Nature.*

Sugar Beet and Beet Pulp for Dairy Cows

Colorado is one of the States in America in which the beet sugar industry is making considerable strides, and, as a consequence, the profitable utilisation of the enormous quantity of low grade but succulent fodder in the form of beet pulp is a question among farmers there of great importance. The State Experiment Station has been endeavoring to arrive at a satisfactory estimation of the value of beet pulp and sugar beets when fed to cattle along with grain and hay. The large amount of water present in the pulp renders it an article quite unfit for feeding alone to stock, in fact, it would be almost impossible for a cow to eat enough pulp, if given no other food, to sustain herself in proper health. About fifty pound of beet pulp or twenty-five pounds of beet is about the maximum that can be fed with profit to cows in conjunction with hay and grain.

The function of roots in feeding to stock is to prevent mal-nutrition and ensure good general health rather than the supply of food. The food nutrients can be supplied in concentrated form, but before the animal can make use of them the digestive organs must be filled up and distended, and the food must be readily permeable by the digestive fluids. The great value of beet and beet pulp consists in the fact that they contain a large amount of plant juices, which dilute, soften and separate the particles of dry grass hay and grain, so that the nutritive qualities of the whole feed may be more easily and thoroughly digested.

The rations employed in the experiment under review were as follows :—

Beet.	Pulp.
4 lbs. Crushed Maize.	4 lbs. Crushed Maize.
4 lbs. Crushed Wheat.	4 lbs. Crushed Wheat.
20 lbs Lucerne Hay.	20 lbs. Lucerne Hay.
12 lbs. Beets.	24 lbs. Beet Pulp.

Five cows were fed on the above rations, the first week beet and the second pulp, and so on alternately for eleven weeks. When on the pulp ration these five cows gave an average weekly milk yield of 131 lbs. and a butter yield of 6¾ lbs. On the beet ration the average weekly milk yield was 127 lbs. and a butter yield of 6·9 lbs., the milk containing a little more butter-fat when sugar beets were used instead of pulp.

A little more than three times as much profit resulting from feeding 24 lbs. of pulp per day than was realised from 12 lbs. of beet per day, reckoning their cost at 4s. and 16s. per ton respectively. The total profits indicated a feeding value of the pulp for butter producing, under the conditions existing at the time of the trial, of about 11s. per ton, and beets about 20s. per ton, butter being reckoned as worth 10d. per lb.

Preserving Samples of Milk for Testing.

According to R. W. Clark, Assistant Agriculturist at the Alabama Experiment Station, U.S.A., the most satisfactory method for factory managers of preserving the composite milk samples for testing consists in the addition of half a teaspoonful of formalin to each pint of milk. This gives a one-half per cent mixture, which will remain in good condition for testing for one month in any season. Potassium bichromate and Mercuric chloride were tried but gave unsatisfactory results.

The Most Popular Peach in America.

Of the four hundred or more varieties of the peach in America, perhaps none has wider dissemination and received more popular favour than the Elberta. It originated in Georgia and was discovered by Samuel H. Humph of Marshallville, who selected it as the most promising of several hundred seedlings he produced from seed planted in 1870. In parentage it comes from our very best strains of peaches, and is presumably a cross of Chinese Cling on Early Crawford. The tree is a vigorous grower, with an unusually strong healthy foliage. The fruit is large and highly colored, and has most excellent shipping qualities. It is well adapted to a wide range of conditions and is at present the most universally planted commercial variety in this country. In quality it is good, but some others are superior in delicate texture and flavour. Owing to its size and handsome appearance, it is

one of the most popular peaches on our general market. It is claimed by some well-informed fruit-growers that the peach-growing public has gone "Elberta wild." It is feared that with the enormous number of these trees planted, markets will be overstocked with this variety in some sections, thus interfering with the price usually received for this product. The season varies with conditions. In Georgia, in 1901, it was at its best from July 20th. to August 5th.; while on the Chesapeake peninsula, August 20th. to 30th. was the date. While the Elberta is without doubt a good commercial variety, it should not be planted to the exclusion of others of equal merit.—*American Agriculturist.*

Bolting of Cabbages.

The old school of English gardeners, according to a correspondent in the *Gardeners' Chronicle*, were very particular in selecting plants for seed. They would go through their fields of cabbage and place a stake against every plant that was hearting early; these would be gone over again two or three times, and all the indifferent ones removed, and only the very best left as seed producers. The hearts were eventually cut, leaving the stumps to stand, and in the autumn, when sprouts had appeared, these stumps were taken up and re-planted deeply, leaving only the tips of the sprouts visible, and it was these sprouts which produced seed in the following summer. In this way fine stocks were produced and bolting reduced to a minimum. Some who grow for seed take less trouble; they content themselves with sowing the seed in drills and leave them there to produce seed. But it is obvious this perhaps more rapid, but certainly less laborious process, could scarcely operate to secure the fine, pure even stocks obtained by the more methodical process.

Canned Apples.

Some time ago Mr. J. M. Sinclair sent from London to the Department of Agriculture a report dealing with canned apples from the United States and Canada. He found that an enormous trade was being done in this class of fruit, which was finding a profitable outlet in Great Britain. Full details were given regarding the process of canning apples, and brief mention only may be made to the trade itself. In Great Britian these apples are regarded with great favour, and their consumption in large hotels, restaurants, and by families is of an extensive character. In this form they can be kept throughout the year, and for cooking purposes, being ready pared and cored, find almost as much favor as the fresh fruit. Large hotels and restaurants in London and provincial cities often purchase stocks from 500 to 1000 cases for use at periods during the year when the fruits are dear or are in short supply in the market. In Victoria the canning of apples does not seem to have received any particular attention, although a large portion of the crop hardly suitable for shipping in the fresh state might be packed and exported in this way. They should find a large outlet in South Africa, India, and the East, and Western Australia.

By the trade in Great Britain they are known as "gallon" apples, on account of the size of the tins in which they are packed. The weight of fruit in each tin would appear to be 6 to 8 lbs. For best brands, such as Curtice Bros. Co., Rochester N.Y., the average wholesale price obtained is about 10s. per dozen and 9s. for secondary grades. These retail for about 1s. per tin. Mr. Sinclair obtained a case of United States and one of Canadian canned apples and sent these to the Department, so that they could be seen by growers or fruit canners in the State. The process, which was a simple one by heating the fruit with hot water, was fully described in the report forwarded to the Department of Agriculture, from whom it can be obtained on application by growers or those interested in the matter.

RAINFALL IN 1903.

First Quarter.

(By P. Baracchi.)

The distribution of rainfall over the State in the first three months of the year, as shown in the accompaning tables, may be summarized as follows :—

January.—Rainfall slightly above average in the extreme South Western districts and Otway Forest. Considerably below average in all other parts, and far more so over the Northern half of the State and Gippsland, east of the Latrobe River. The deficiencies range from 17 per cent. over the Yarra basin to 80 per cent. in the Mallee and 90 per cent. over the Avon and Richardson River basins.

February.—Rainfall very considerably below average over the Macallister, Mitchell. Tambo, and Snowy River basins, also over the Murray districts, the Mitta Mitta, and Ovens River basins. About the average, or slightly above it, over the Goulburn, Campaspe, and Lodden River basins. Considerably above average over the Mallee, Wimmera East and West, the Avoca, and Avon River basins.

March.—Rainfall very considerably above average from 10 to 50 per cent. over all Southern districts from the Glenelg to the Macallister Rivers, and over all Northern districts including the extreme North-West. About the average over the Mitchell, Tambo, and Nicholson River basins. Below average over the Snowy River basin.

General Summary for 1st Quarter.

Extreme South-Western Districts	Rainfall from	75 to 97	per cent.	above	Average.	
Central South-Western Districts between the Hopkins and Moorabool River basins.	,,	,,	33 to 46	,,	,,	,,
Moorabool and Barwon River basins.	,,	,,	10 per cent.		,,	,,
Districts South of the Ranges, East of Port Phillip Bay as far as the Latrobe River.	,,	,,	30 to 60	,,	,,	,,
Eastern Wimmera and Goulburn River basins.	,,	,,	30 to 40	,,	,,	,,
Western Wimmera.	,,		7 per cent.		,,	,,
Werribee and Saltwater River basins, the basins of the Campaspe and Avoca Rivers, the extreme North-Eastern Districts and the Mallee Country.	,,	,,	2 to 8	,,	below	,,
Murray Districts, basins of the Loddon, Avoca, and Richardson Rivers.	,,	,,	14 to 21	,,	,,	,,
Basins of the Macallister, Avon, Mitchell, Tambo, Nicholson, and Snowy Rivers.	,,	,,	50 per cent.	,,	,,	,,

TABLE SHOWING RAINFALL over the 26 basins or regions constituting the State of Victoria, recorded in the first quarter of the year 1903, together with corresponding averages deduced from all the records of past years, and the total amounts for the first quarter of the previous eight years.

Name of Basin.	FIRST QUARTER.						TOTAL FOR FIRST QUARTER.									
	January		February		March.											
	Amt 1903.	Avg	Amt 1903.	Avg.	Amt 1903.	Avg	1903.	1902.	1901.	1900.	1899.	1898.	1897.	1896.	1895.	Avg.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Glenelg and Wannon Rivers	1·69	1·44	1·76	0·62	2·44	1·32	5·89	3·27	3.86	5·35	6·39	1·26	3·74	4·97	4·47	3·38
Fitzroy, Eumerella and Merrie Rivers ..	2·02	1·48	2·79	0·79	2·63	1·51	7·44	4·10	4·69	5·68	8·43	1·46	4·77	5·40	4·59	3·78
Hopkins River and Mt. Emu Creek ..	1·38	1·48	1·65	0·71	2·13	1·52	5·16	3·73	4·12	5·27	7·50	1·75	5·16	5·42	4·07	3·71
Mt. Elephant and Lake Corangamite .	0·93	1·43	1·49	0·84	2·61	1·52	5·03	4·26	4·06	5·27	8·11	1·30	6·22	6·12	3·75	3·79
Otway Forest..	1·91	1·62	2·18	0·99	2·85	2·14	6·9	8·20	5·35	7·03	13·01	2·93	8·73	7·80	4·40	4·75
Moorabool and Barwon Rivers ..	0·89	1·44	1·37	1·04	2·29	1·67	4·55	6·00	4·68	4·98	6·83	1·17	8·59	6·19	3·72	4·15
Werribee and Saltwater Rivers ..	0·94	1·48	1·26	1·36	2·18	1·95	4·38	8·49	5·01	6·06	6·69	0·99	9·00	6·06	3·98	4·79
Yarra River and Dandenong Creek ..	1·61	1·94	2·42	1·28	4·82	2·31	8·85	9·50	8·89	10·20	9·54	2·69	13·21	7·98	4·82	5·53
Koo-wee-rup Swamp	1·25	1·77	1·84	1·24	4·42	2·15	7·51	9·62	8·37	10·40	8·75	2·02	13·04	8·32	3·98	5·16
South Gippsland	1·44	2·04	1·33	1·67	4·93	2·32	7·70	9·99	10·22	10·94	9·56	4·45	16.31	7·58	5·09	6·03
Latrobe and Thomson Rivers.. .	1·33	2·15	1·60	1·55	4·80	2·34	7·79	9·43	10·18	9·41	7·62	4·90	16·07	6·90	4·40	6·04
Macalister and Avon Rivers	0·43	2·01	0·40	2·29	2·10	1·65	2·93	8·40	4·54	5·58	5·36	4·45	13·70	5·94	3·88	5·95
Mitchell River	0·53	2·26	0·60	2·52	1·93	1·95	3·06	11·27	4·37	7·90	5·24	5·40	17·61	6·48	4·36	6·70
Tambo and Nicholson Rivers	0·85	3·05	0·63	1·44	1·63	1·67	3·14	9·81	4·36	6·95	5·26	5·86	16·55	5·57	4·84	6·16
Snowy River	1·42	3·07	0·61	2·19	1·66	2·50	3·69	9·38	5·92	7·07	5·39	7·25	18·66	6·19	5·48	7·76
Murray River..	0·37	1·37	0·67	1·29	2·69	1·84	3·73	2·73	2·27	5·31	4·23	2·89	4·33	5·06	4·42	4·50
Mitta Mitta and Kiewa Rivers.. .	0·52	1·72	1·07	2·26	4·04	2·17	5·63	5·04	3·37	8·61	6·64	6·65	7·47	7·18	6·27	6·15
Ovens River	0·53	2·39	1·24	2·01	4·64	2·33	6·41	5·77	4·15	10·22	9·31	5·43	8·10	10·30	5·83	6·73
Goulburn River	0·58	1·47	1·18	1·06	3·95	1·68	5·71	4·26	2·45	5·70	5·82	3·04	5·27	4·76	4·56	4·21
Campaspe River	0·50	1·29	0·88	0·91	2·40	1·83	3·78	4·55	2·55	4·37	6·10	2·16	3·81	3·67	4·13	4·03
Loddon River..	0·43	1·11	0·67	0·63	1·54	1·32	2·64	2·92	1·61	3·38	4·85	1·76	3·55	3·80	3·13	3·06
Avon and Richardson Rivers	0·10	0·90	0·64	0·41	1·03	0·95	1·77	2·40	1·98	2·01	4·07	1·25	4·28	3·62	2·55	2·26
Avoca River	0·22	0·85	0·56	0·28	1·38	1·19	2·16	2·14	1·44	2·55	4·65	1·53	3·58	3·80	2·43	2·32
Eastern Wimmera	0·57	1·02	0·93	0·32	1·63	0·88	3·13	1·74	1·65	3·26	4·50	1·15				2·22
Western Wimmera	0·51	1·16	0·70	0·36	1·70	1·20	2·91	2·62	2·34	3·12	5·92	1·01	4.35	4·06	2·52	2·72
Mallee Country	0·15	0·82	0·42	0·22	1·31	0·88	1·88	1·42	1·00	2·31	4·22	1·17	2·75	2·93	2·01	1·92
Average for the State	0·74	1·48	1·03	0·97	2·47	1·55	4·24	4·72	3·47	5·29	6 03	2·66	6·93	4·99	3·74	4·00

AGRICULTURAL CLASSES.

A Series of Lectures and Practical Demonstrations in Agriculture and Allied Sciences to be held in the Coming Winter under the Auspices of the Council of Agricultural Education and under the Direction of Mr. S. Williamson Wallace, Director of Agriculture.

Regulations.

The Short Courses of Instruction for Farmers and Farmers' sons will be held in the towns of Horsham, Boort, Kyneton, Ballarat, Geelong, Shepparton, Maffra, and Warrnambool, during the months of June, July, August, and September under the following conditions :—

Instruction will continue for a period of four weeks in each centre.

Three lectures will be delivered in the afternoon of each day for five days a week.

No charge will be made for instruction.

Farmers and Farmers' sons or men who have worked at least one year on the land are eligible for admission.

Those attending may be of any age over 16 years.

No entrance examination will be held.

A final examination in every subject will be held, but attendance at this examination will be optional.

Those who pass the final examination with credit will be awarded a certificate.

The Australian Natives Association will present a Gold Medal to the most successful Student of all those attending the Short Courses of Instruction.

A free library consisting of approved Text Books, will be available under Regulations during the month at each centre.

Classes will be formed at the above-mentioned towns if the following conditions are complied with :—

1. At least 40 eligible students must be enrolled before the 15th May.
2. The Agricultural Society or some local body must bear all local expenses—such as providing a suitable Hall, advertising in local papers, &c.

If the above conditions are not complied with, no class will be held in that particular centre this year.

These classes are not intended for local students only. Any Farmer or Farmer's son in the State of Victoria may attend.

Arrangements have been made with the Railway Department that return tickets available for one month will be issued to those travelling to attend the classes at Holiday Excursion Fares.

Such tickets will be obtainable on presenting a Certificate to the Station Master, signed by the Secretary for Agriculture, stating that the passenger is a student proceeding to attend a course of instruction at one of the centres.

The Secretaries of Agricultural Societies will prepare a li of respectable and comfortable lodgings.

Intending students should consequently correspond with the Secretaries of Agricultural Societies regarding rooms.

A comfortable room with Board can be had for 17s. to £1 a week in each centre.

During the course at Geelong instruction will be given in Analytical chemistry and Wool-sorting for three hours in the forenoon, viz.:—from 10 a.m. to 1 p.m., during five days in the week. This addition to the Course is for the purpose of occupying the whole time of the students who come from a distance and lodge in the town. Consequently those who attend from other parts of the State should select Geelong.

As accommodation is limited for Analytical work and Wool-sorting, preference will be given: Firstly, to students coming from a distance; and secondly, to those who travel to Geelong daily by train.

A charge of 6s. will be made for chemical apparatus, payable only by students who take the class in Analytical chemistry.

Syllabus of Lectures and Demonstrations.

Manures and Manuring.

The Course will include nine (9) Lectures embracing an introductory one explanatory of the principles of the subject, followed by Lectures on :—

Commercial Fertilizers.
Farmyard Manure.
Lime and Its Functions in Agriculture.
Humus in its relation to Soil Fertility.
The Manurial Requirements of Northern Soils.
Manure Experiments in Southern Victoria.
The Nitrogen Requirements of Southern Soils.
How to Value Manures.

Animal Nutrition.

The Course under this head will include nine (9) Lectures, and will open with one explanatory of the principles of the subject. Following the explanation of the principles of feeding, lectures will be given on :—

Rations for Dairy Cows.
Feeding for Beef Production.
The Working Horse and His Food Requirements.
The Feeding of Sheep.
Forage Crops for Pigs.
Lucerne for Milking Cows.
Silage and Silos.
Saltbush as a Fodder for Dry Areas.

Stock and the Management of the Dairy.

The Plant.—How it Grows and Prepares Food for Animals.
Mastication, Digestion, and Assimilation of Food by Animals.
The Principles of Breeding.
The Breeding and Management of Sheep.
The Breeding and Management of Pigs.
The Breeding and Management of the Horse.
The Management of Dairy Cattle.
The Formation and Production of Milk.
The Treatment of Milk from Farm to Factory.
A Discussion on the Various Breeds of Cattle.
Canadian Cheddar Cheese.—Tracing the Milk from the Cow to Market.
The Growth and Conservation of Fodder Crops.
The Planning of Farm Buildings.
The Treatment of the more common Ailments of the Horse.
The Treatment of the common Ailments of Cattle.
The Treatment of the common Ailments of Sheep and Pigs.

Sheep-breeding and Wool-sorting.

Sheep.—Wild and Tame.
Origin of Different Breeds.
Ancient Sheep.—Early European.
The Merino.—Introduction into Australia.
British Breeds most useful to Australia :—
Lincoln, Leicesters, Border Leicesters, Romney Marsh, Shropshires, Hampshires, Suffolk, Dorset, Southdowns.
Selection of Sheep.—Country and Climatic Conditions considered.
Sheep-breeding.—The Merino, Selection of Rams and Ewes, Different Types of Merino.
Crossbred Breeding.—Mating of Sheep to Produce the true Comeback. Demonstrated by Specimen Wool Samples.
Breeding for Mutton.—Wool and Early Lambs.
Management of Sheep.—Culling, Drafting, Dipping, &c.
Shearing.—Preparing Wool for the Market.

Large Clips.—Picking up, Skirting, Rolling, Classing, Pressing, Branding.

Small or Farmer's Clips.—Both Large and Small Clips Demonstrated by Wool Samples.

Poultry.

Locality.—Its importance to successful raising of Poultry.

Construction of Houses.—Aspect, which plays a most important part in poultry farming, Insect proof buildings, and how to cope with Tick and other vermin that attack fowls.

Selection of Stock.—Breeds that will bring top prices for export.

Modes of Crossing, &c.—Egg producing breeds, the proper mating of the various breeds; how many hens a Breeding Pen should consist of and the proper ages of the sexes.

How to Produce a greater percentage of Cockerels for export, also to produce a large percentage of Pullets if required.

The Importance of Proper Foods to successful Poultry Culture and a practical demonstration of How to Mix.

The Importance of the Kitchen Garden as an essential to success, and Green Foods required by Stock. The part they play in building up the tissues of Young Stock.

The Great Necessity of Grit for the Gizzard's proper work (demonstrated).

Changes of Season as affecting Stock.

What should be Done to Keep Away Diseases in Poultry—their cause and cure.

Breeding from Diseased or Deformed Stock.

Dates for Hatching in Northern and Southern parts of Victoria.

Incubation by Hen or Machine.

Causes of Dead Chicks in Shell and How to Avoid.

How to Discover if Tick is on your Farm and a Certain Remedy for Eradicating the Pest cheaply.

Practical Demonstrations in Poultry Dressing.

Theoretical Chemistry.

The Province of Chemistry; Physics and Chemistry compared; Chemical Combination and Mechanical Mixture; The Causes of Chemical Action; The Different Kinds of Chemical Action; Compounds and Elements; Names and Symbols; Formulae and Equations; Weight Proportions in the Union of Elements; Law of Constant Proportions; Atomic Molecular Theory; Density of Bodies in a State of Gas; Volume Proportions in the Union of Gases; Avogadro's Law; Nature of Acids; Bases and Salts.

The Chemistry of the following Elements and their Compounds, as being of primary importance from an Agricultural aspect, will receive particular attention:—Hydrogen, Oxygen, Nitrogen, Carbon, Sulphur, Phosphorus, Potassium, Sodium, Calcium, Magnesium, Iron, Manganese, Aluminium, Silicon, Chlorine, Fluorine, Boron, Barium.

Agricultural Chemistry.

The relations of Chemistry to Agriculture.—How a knowledge of the science assists the farmer. The elementary constituents of plants and animals.

The Atmosphere.—Its chemical composition. The relations of the atmosphere to plant and animal life.

The Plant.—Its structure and modes of growth; Functions of the root, leaf and stem. The chemical composition of the ash of plants.

The Soil.—Chemical composition; Diversities and Causes; The Physical proprieties of soils; Density: Absorptive power for Water; Capillary Action; Evaporative Power; The Analysis of Soils; In how far analysis serves as an index of fertility; The Chemical Characteristics of Victorian Soils; Available and unavailable forms of plant food; The improvement of soils; Drainage and Tillage: The Chemical effects of Ploughing; Deep Ploughing and Subsoiling; Lime as an alterative agent on soils; The Manuring of Lands; Stock of Plant Foods in the Soil; Continuous Cropping and Soil Exhaustion; Why we Manure; The Plant Foods usually required in Manuring; Direct and Indirect Manures; Soil Deficiencies in Northern Victoria; The Manuring of Cereals; Sources of the different manures; Nitrogenous, Phosphatic and Potassic Manures; Valuation of Manures; Profitableness of Manuring.

Farm Crops and Their Requirements.—The Rotation of Crops; The advantage of growing crops in rotation.

Animal Nutrition.—The Functions of Food; Composition of Vegetable Food Stuffs; Nutrient and Non-nutrient Constituents; The Balanced Ration; The Food Requirements of the Growing, Fattening, Working and Milk-giving animal.

The Chemistry of Dairy Products.—Milk, Butter, Cheese.

Agricultural Botany.

Introductory.
Seeds.
Roots.
Leaves.
Stems.
Flowers.
Fruits and Seeds.
Cells.
Plant Physiology.
Plant Food.—Its absorption and assimilation.
Growth.
Reproduction.
The Origin and Development of our Commonest Economic Plants.
Hybridisation.

Viticulture.

The Vine.—Its history, physiology, propagation, &c.

The Vineyard.—Soil, aspect, &c.; preparation of land, ploughing, drainage, &c.; subsequent treatment.

The Phylloxera.
American Vines.
Grafting, Budding, &c.
Fungus and Other Diseases.

Insect Pests and Plant Diseases.

Attention will be drawn to the various agencies which produce diseases in plants, and the more commonly occurring Insects and Fungus Pests will be specially treated.

The symptoms of each disease will be clearly described, and the best known remedies given.

The preparation and use of Insecticides and Fungicides will be fully explained.

Among the Pests, chiefly Insect, will be noted :—

Mussel Scale and Root Borer of the Apple.
San José Scale.
Pear and Cherry Slug.
Codlin Moth.
Woolly Aphis.
Peach Aphis.
Cabbage Moth.
Fruit Flies and Red Spider.
Lucerne Flea and Potato Moth.
Orange and Lemon Scale.

And of Fungus Diseases the following will receive attention :—

Black Spot of the Apple and Pear.
Shot Hole and Scab of the Apricot.
Peach Leaf-curl, and Plum Leaf-rust.
Club Root of Cabbage.
Potato Scab.
Smuts and Bunt.
Rust of Wheat.
Collar Rot and Root Rot.

The Phylloxera and Fungus Diseases of the Vine will be treated in the Course on Viticulture.

Lecturers.

Lee, F. E.—Manures and Manuring. Animal Nutrition.
Archer, R. T.—Stock and the Management of the Dairy.
Haile, W.—Sheep-breeding and Wool-sorting.
Hawkins, H. V.—Poultry.
Osborn, R. M.—Theoretical chemistry and Agricultural chemistry.
Garnsworthy, P. S.— ,, ,, ,, ,,
Robertson, W. C.— ,, ,, ,, ,,
Trend, E.— ,, ,, ,, ,,
Adcock, G. H.—Agricultural Botany and Viticulture.
Cock, S. A.—Insect Pests and Plant Diseases.
Meeking, Edwin.— ,, ,, ,,
Hart, A.—Demonstrations in Poultry Dressing.

STATISTICS.

Perishable and Frozen Produce.

Comparison of Perishable and Frozen Products Exported from the Government Cool Stores, Flinders Street. and the total from Victoria for the months of March, 1902 and 1903 respectively.

Description of Produce.		Govt. Cool Stores		Total From Victoria.		*Increase †Decrease
		1903	1902	1903	1902	
Butter (Victorian)	lbs.	206,752	230,104	732,368	464,704	* 267,664
,, (Ex Bond)	,,	11,816	144,928	—	—	—
Milk & Cream (Concentrated)	cases	797	795	882	987	† 105
Cheese	lbs.	—	—	62,310	4,080	* 58,230
Eggs	doz.	8,680	13,270	9,720	15,690	† 5,970
Ham and Bacon	lbs.	—	—	80,892	—	80,892
Rabbits and Hares ..	pairs	191,153	227,966	328,404	235,632	* 92,772
Game	head	—	1,183	—	1,183	† 1,183
Poultry	,,	3,534	9,061	19,395	9 645	* 9,750
Mutton and Lamb.. ..	carcases	8,342	3,759	13,940	8,248	* 5,692
Veal	,,	260	88	636	96	* 540
Beef	qrtrs.	—	—	600	228	† 372
Fruit	cases	8,794	3,517	33,715	27,245	* 6,470
Fruit Pulp	,,	378	1,258	1,040	4496	† 3,446

Particulars of Perishable and Frozen Products Exported from Victoria for the First Quarter of 1902 and 1903.

Description of Produce.		1903	1902	*Increase. †Decrease.
Butter	lbs.	3,709,205	3,272,560	* 436,645
Milk and Cream (Concentrated) ..	cases	3,965	3,599	* 366
Cheese..	lbs.	128,070	15,320	* 112,750
Eggs	dozens	18,062	29,760	† 11,698
Poultry	head	37,770	30,194	* 7,506
Game	head	—	1,183	† 1,183
Rabbits and Hares	pairs	1,022,760	672,928	* 349,832
Mutton and Lamb	carcases	156,320	141,717	* 14,603
Veal	,,	2,556	328	* 2,228
Beef	,,	328	120	* 208
Fruit	cases	52,091	33,896	* 18,195
Fruit Pulp	,,	1,040	6,953	† 5,913

Arrivals of Butter and Butter as Cream, in Tons Net by Rail and Steamer in Melbourne from the different Districts of Victoria for the Months of January, February and March, 1902 and 1903 respectively.

Months.	Totals.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
January ..	1,792	1,621	306	257	56	106	836½	765	593½	493
February ..	1,373½	1,169½	90½	196	47½	50	814	630	421½	293½
March.. ...	1,370	977½	112	92	27	25	740½	650	490½	210½
Totals ..	4,535½	3,768	508½	545	130½	181	2,391	2,045	1,505½	1,007

This comparison shows, notwithstanding the shortage in arrivals from the North-Eastern and Northern Districts, in consequence of the drought, the total arrivals for 1903 are heavier by 767½ tons than for the first quarter of last year. The fact that Gippsland has the latest season for dairying accounts for some of the greater production shown.

R. CROWE.

Fruit and Plants.

FRUIT Inspected for Export to Australian States and New Zealand only, during January, February, and March, 1903.

Fruit.	No. of Cases Inspected.	No. of Certificates Given.
Apples	26,041	599
Apricots	2,353	170
Bananas	3,866	846
Cherries	142	28
Cucumbers	128	84
Figs	23	9
Grapes	4,606	679
Lemons	972	205
Melons	124	24
Mixed Fruits	314	5
Nectarines	151	76
Oranges	550	201
Passion Fruit	189	83
Peaches	2,567	652
Pears	65,067	949
Pineapples	781	280
Plums	5,951	265
Quinces	486	36
Raspberries	4	1
Tomatoes	1,652	221
Total	115,967	5,413

PLANTS, &c., Inspected for Export to Australian States and New Zealand only, during January, February and March, 1903.

Number of packages inspected	8
Number of certificates given..	6

FRUIT Inspected for Export to the United Kingdom during January, February and March, 1903.

Fruit.	Cases.
Apples	47,137
Grapes	201
Pears	3,433
Total	50,771

J. G. TURNER.

Farm Produce.

FARM PRODUCE Exported and Certified to during January, February and March, 1903.

Shipped to.	Produce.	Number.	Approximate Weight.
South Africa	Onions	2,880 bags	192 tons
	Seed Oats	18,181 ,,	72,520 bushels
	Hay	1,424 bales	60 tons
	Haricot Beans	200 bags	20 ,,
	Rye-grain	10 ,,	10 cwt.
	Lucerne	5 ,,	8 ,,
	Mixed Seed	9 ,,	10 ,,
	Barley (seed)	25 ,,	100 bushels
New South Wales	Potatoes	8,598 bags	710 tons
	Onions	7,884 ,,	520 ,,
	Oats	1,041 ,,	4,160 bushels
	Barley	31 ,,	120 ,,
	Chaff	2,250 ,,	50 tons
Queensland	Potatoes	23,915 bags	1,980 tons
	Onions	5,556 ,,	369 ,,
	Oats	825 ,,	3,300 bushels
	Hay	48 ,,	2 tons
West Australia	Potatoes	4,847 bags	400 tons
	Onions	970 ,,	60 ,,
South Australia	Potatoes	383 bags	31 tons
	Onions	360 ,,	24 ,,
New Zealand	Potatoes	109 bags	7 tons
	Onions	26 ,,	2 ,,
Manila	Onions	990 cases	30 tons
London	Raspberry pulp	378 cases	15 tons

J KNIGHT.

DAIRYING,

Laboratory Courses for Butter and Cheese Factory Managers, Vignerons, and others.

Courses of Laboratory work in applied Bacteriology lasting a fort night each have been arranged as follows :—

TERANG, May 11th.

TRARALGON, August 3rd.

KORRUMBURRA, August 17th.

MOOROOPNA, September 7th.

The Classes will be held at hours to suit the convenience of the majority of the students. No fees are charged for the course and microscopes and all necessary apparatus are provided by the Department. Those wishing to join are requested to communicate with the Secretary of the local factory, or with Dr. Cherry as soon as possible.

Agricultural Societies and other Bodies wishing to have evening lectures on the Dairying Industry are requested to make early application, so that the lectures near each of the above centres may be arranged while Dr. Cherry is conducting each of the above classes.

PUBLICATIONS ISSUED BY THE DEPARTMENT.

Bulletins.

Reprinted from the Journal.

No. 1. Impressions of Victoria from an Agricultural Point of View. By S. Williamson Wallace.
No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
No. 3. Black Spot of the Apple, together with Spraying for Fungus Diseases. By D. McAlpine.
No. 4. Review of the Past Butter Season. By R. Crowe.

Guides to Growers.

No. 19. Lavender. By J. Knight.
No. 20. Broom Corn. By J. Knight.
No. 24. The Fig Industry. By C. B. Luffmann.
No. 25. Cultivation and Treatment of Tobacco. By A. J. Bondurant.
No. 26. Treatment of the Raisin Vine. By C. B. Luffmann.
No. 27. Insect Pests and Fungi. By C. French and D. McAlpine.
No. 28. Regulations under the *Vegetation Diseases Act* 1896.
No. 31. Wheat Experiments, 1896 By Hugh Pye.
No. 32. Fungus Diseases of the Raspberry By D. McAlpine.
No. 41. Cider-making. By J. Knight.
No. 46. Purifying Water for Butter-making and for Country Purposes Generally. By A. N. Pearson.
No. 47. Manures in the Victorian Market. By. A. N. Pearson.
No. 48. Codlin Moth Experiments. By C. French.

Revised List of Fruit Trees, &c., Recommended for Cultivation as Suitable for Marketing, Canning, Drying, Exporting, &c.
Modern Dairying. By D. Wilson and R. Crowe.
Report on the Preservation of Fruit for Shipment. By J. M. Sinclair.
Report on Meat Inspection in the United States. By J. M. Sinclair.
The Butter Industry of Victoria and the British Export Trade. By J. M. Sinclair.
Prospectus and Regulations of the Agricultural College and the School of Horticulture, with Syllabus of Instruction.
Report on Wheat Experiments at Port Fairy and in the Mallee. By D. McAlpine.
Poultry Breeding and Management for the English Markets.
Report on Successful Farming in the Mallee. By F. J. Howell, Ph. D.
List of Butter and Cheese Factories in the State of Victoria.
Manures and Manuring. By A. N. Pearson.
Influence of the Elementary Plant Foods on Plant Growth. By A. N. Pearson.
The New Agriculture. By the Hon. I. A. Isaacs.
List of Exporters of Agricultural Products.
The Scientific Directing of a Country's Agriculture. By A. N. Pearson.

Report by Hugh Pye, Principal, Agricultural College, Dookie, on the Experimental Work of the College for 1899-1900.
Silos and Ensilage. By J. L. Thompson.
Additions to the Fungi on the Vine in Australia. By D. McAlpine.
Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
Chart for the Guidance of Dairymen. By R. Crowe, Dairy Expert.
Directions for Preparing Starters. By H. W. Potts, F.C.S.
Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
Report on Field Experiments in Victoria, 1887-1900, Section Manuring. By A. N. Pearson.

Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
Report of Conference on the Elevator System in the Handling and Shipment of Grain.
Annual Reports, 1899, 1900 and 1901.
Report on the Hog-Raising and Pork-Packing Industry in the United States, and on the Live Stock and Frozen Meat Exportation of the Argentine Republic. By J. M. Sinclair.

Any of the above may be had Free, on application to the Secretary for Agriculture.

Destructive Insects of Victoria, Parts I., II., III. By C. French. Price 2s. 6d. each.
Fungus Diseases of Citrus Trees in Australia. By D. McAlpine. Price 2s.
Fungus Diseases of Stone Fruit Trees in Australia. By D. McAlpine. 165 pp., 10 colored plates. Price 2s. 6d.
Fungi of Australia. By Dr. Cooke. Price £1 1s.

WORKS ON VITICULTURE. TRANSLATED FROM THE FRENCH BY R. DUBOIS AND W. PERCY WILKINSON.

Wine-making in Hot Climates. By L. Roos. 273 pp., 61 illustrations, 5 plates. 1900. Cloth-bound, 2s.
First Steps in Ampelography. By Marcel Mazade. 95 pp., 43 illustrations. 1900. Cloth-bound, 1s.
Trenching and Sub-soiling for American Vines. 171 pp., 110 illustrations, 10 plates. 1901. Cloth-bound, 2s.
New Methods of Grafting and Budding as applied to Reconstitution with American Vines. 72 pp., 89 illustrations. 1901. Cloth-bound, 1s.
American Vines: Their Adaptation, Culture, Grafting, and Propagation. By P. Viala and L. Ravaz. 297 pp., 150 illustrations, 10 colored plates. 1901. Cloth-bound, 3s. 6d.
Studies on Wine-sterilizing Machines. By U. Gayon. 103 pp., 45 illustrations, 2 colored plates. Cloth-bound, 2s.

PROSPECTUS

OF THE

School of Horticulture.

The school is designed for the teaching and training of orchardists gardeners and managers of fruit-growing properties. It is situated in a near suburb of Melbourne, and has a good tram and train service.

The estate comprises upwards of 40 acres of varied land, of which twenty are at present devoted to fruit trees, vegetable culture, a nursery and flower gardens.

New stables, plant houses, frames, sheds and other buildings have recently been erected. Class, dressing, luncheon and work rooms form portion of a large pavilion, wherein shelter and occupation are found in adverse weather.

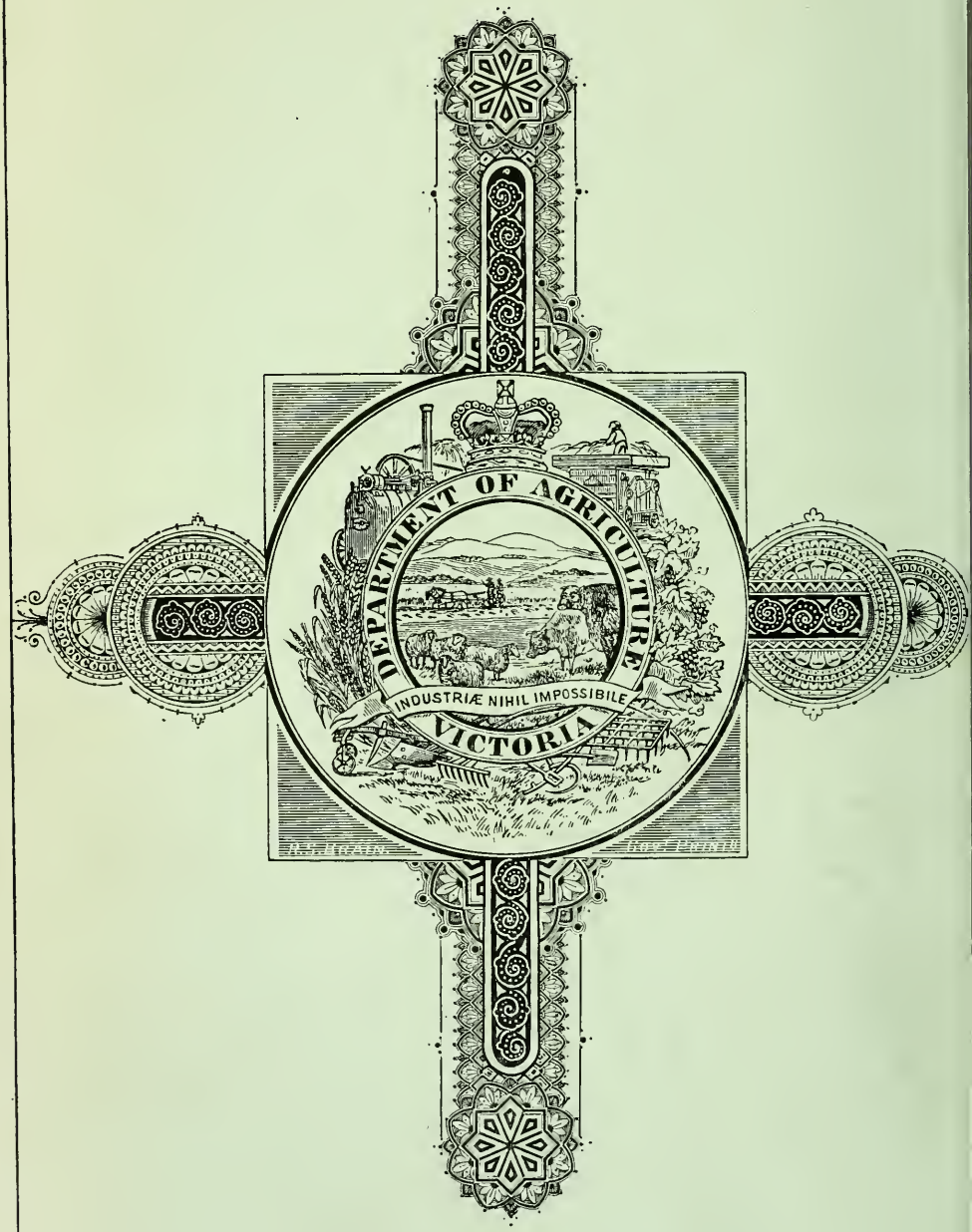
Class-room instruction is given in horticultural science, vegetable pathology, botany, chemistry of soils and plants, physical and commercial geography, entomology, measuring, levelling, designing, and plotting of homesteads, orchards and garden areas, and the most approved methods of raising and managing fruit trees and plants. Practical work includes the propagation and management of orchard trees, citrus, table grapes, bush fruits; harvesting, storing, packing, marketing, drying and canning of fruit, vegetable culture, clearing, grading and trenching of land, management of soils, manures, drainage, villa gardening and care of domestic animals.

Application for admission should be made to the Secretary for Agriculture, Public Offices, Melbourne, from whom further information may be obtained.

AGRICULTURAL, HORTICULTURAL AND VINE, AND FRUIT GROWERS' SOCIETIES.

NOTICE.

It will be an advantage to each Society to have the date of its forthcoming Show duly announced, and Secretaries are requested to furnish the Editor with the requisite information for publication in these columns.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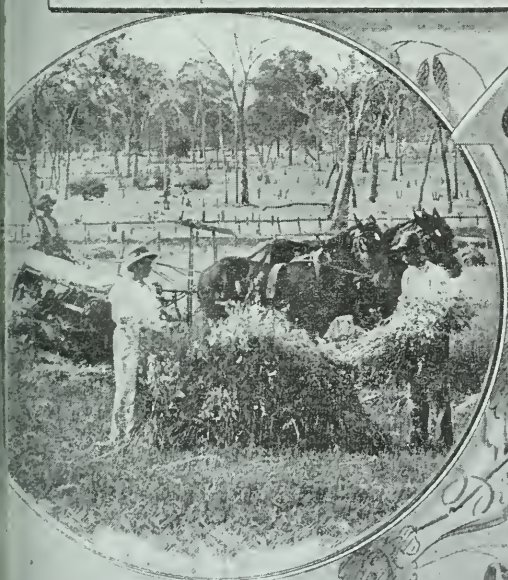

July,

1903

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OF

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Minister for Agriculture.

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1903

The Journal is now issued bi-monthly, that is to say, every alternate month. The Minister of Agriculture has directed that a charge of 2s. 6d. per annum shall be made, and to persons outside the State the charge will be 3s. 6d. Those who desire to receive future issues must, therefore, remit that amount without delay to the Secretary for Agriculture.

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JAPANESE MILLET—SHOWING SECOND GROWTH—UPPER TAMBO.

INTRODUCTORY NOTE TO THE YEAR'S FORAGE EXPERIMENTS.

By the Director of Agriculture.

The output of an Agricultural Department, as of any other department or institution, is controlled by the strength of its staff, and the ability and energy of its directing officers. In a highly specialized department, such as that of America, much can be done, and much of a right may be expected. With the numerous bureaus, and the various divisions or offices in the several bureaus, there is hardly a line of study with an agricultural bearing but what has at its service a special investigator It is not to be wondered at then, that such an important branch as that of Plant Industry should have received marked attention in the States, and that the special office of Agrostology should have been created to take up the important question of grass and forage plant investigations. In Victoria, on my arrival, there was no such office to undertake the work; there was no permanent station or farm, where the work might have been carried out had the office been in existence, nor was there anywhere, except in the Chemical branch, the machinery available to carry out the experiments on private farms in co-operation with the farmers. It was the last reason, principally, which led me to avail myself of that machinery, and to place the forage experiments of last year in the hands of the head of the Chemical Branch, more especially as it appeared to me necessary to carry out such experiments in connection with fertilization investigations. The importance of forage plant investigations will be denied by no one. The interests of both dairymen and graziers are equally affected by the question. There was nothing that so struck me, after my arrival in Victoria, as the endless stretches of bare pastures, and the generally unsatisfactory condition of the herds. In the northern areas it is questionable whether much will ever be done in the introduction of forage crops sufficiently resistant of the long dry summers to prove of much value. But in the south it appeared to me then, as it appears to me now, that a revolution might be effected by a greater attention to the natural pastures, and the

introduction of both summer and winter forage crops. This belief has been justified by the results of the experiments of last year. The work was undertaken at a moment's notice. There was no time for importing seed from abroad, and our choice was restricted to the kinds obtainable on the Melbourne market, but, from the limited number available, there have been a few crops which have proved so successful that it is very probable they will, in a few years, be grown as a regular practice throughout the whole of Southern Victoria. From both the actual results obtained in the field, and the personally formed opinions of farmers, certain of the sorghums appear, in some respects, to claim a superiority even over maize. The Japanese millet has done admirably, and gives evidence of proving a most valuable introduction. The sugar beet, for general feeding purposes and periods of the year when other crops are failing, is spoken of with almost enthusiasm, and rape has shown such an exceptional productive power in the whole area covered by the experiments that the large possibilities of this crop, especially in the direction of sheep-raising and fattening, must strike all very forcibly. The results of the experiments of last year, are sufficiently encouraging to justify a continuance of the work on more extensive lines. The Chemical Branch has, therefore, been instructed to arrange for the importation of seed, and to invite applications from farmers desirous of co-operating in the work. There will be an insistence, however, on compliance with the conditions imposed by the Department, and applications will only be entertained from those giving evidence of a genuine interest in the work. Opportunity is here taken, on behalf of Dr. Howell and myself, for thanking the farmers who kindly co-operated with his Branch in carrying out the experiments. I have also to express my great satisfaction with the energetic and thorough manner in which these duties were undertaken and carried through by Dr. Howell and the officers under him. I recognize the great amount of extra work which these experiments have thrown upon the officers, both professional and clerical, of the Chemical Branch, and they will find their reward in the satisfaction of knowing that the results of their labor will be a benefit to their country.

JAPANESE MILLET.

CO-OPERATIVE FORAGE EXPERIMENTS IN SOUTHERN VICTORIA.

By F. J. Howell, Ph. D.

(A Paper Prepared at the Invitation of the Butter Factory Managers' Association.)

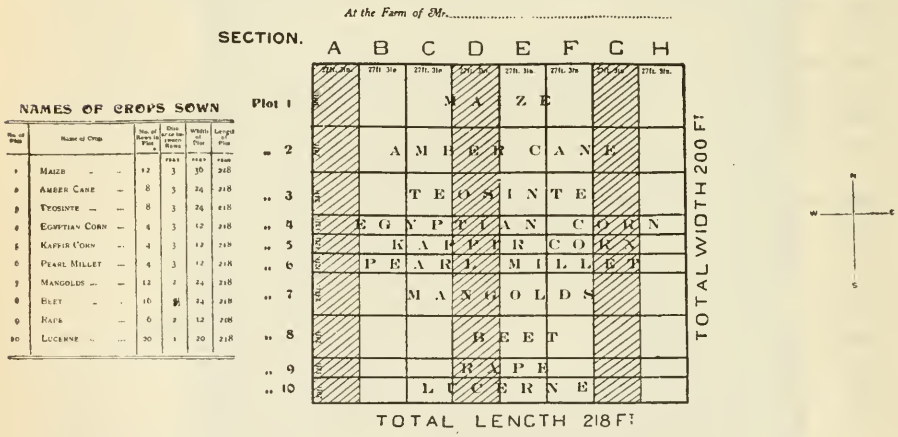
To use the expression which my colleague, Mr. Crowe, made only a few days ago, "The success of the dairy industry, with its large possible future developments, depends mainly upon the attention which will be given to the growth of forage crops throughout Victoria." It is only when we reflect quietly on the enormous yearly loss due to the decrease of the milk supply—brought about by bare pastures and the absence of succulent foods to take their place—that the importance of the subject strikes us with its full force. The question is one which affects you, perhaps, as a body, less directly than it does the dairyman who supplies you with his produce, but your interests, as a body, are so intimately bound up with those of the producer, that this paper will even appeal to yourselves, as holding, perhaps, some few facts which may be considered worth bringing under notice. The Director of Agriculture, shortly after his arrival in Victoria, decided that it was necessary to make experimental field tests to determine the possibility of providing a continuous supply of succulent forage from the period of the first failure of the pastures till the time of the utilization of the early sown autumn fodders in the following year. These questions, naturally involved chemical investigations. For the successful growth of a plant depends not only upon climatic conditions, such as rainfall, temperature, &c., but upon soil conditions also. The chemical composition, and the physical characteristics of a soil, are factors which determine the adaptability of certain localities for special cultures as much, or even more, perhaps, than the climatic conditions peculiar to that district. Investigations then involving questions of this nature fall, naturally, within the province of the chemist, and as such it was the Chemical Branch which was instructed to take up these investigations. The experiments were taken up at a moment's notice, with little or no preliminary preparation. The serious condition of the country, with its bare pastures and starving herds, had brought the forage question into full prominence, and in a measure, forced it upon the immediate attention of the Department. Applications were invited from farmers willing to co-operate in the work and over 100 replies were received, and manures and seeds were distributed to as many centres. Only a small percentage of these fields at harvesting were sufficently complete, and well attended to, to give all the results sought for. In a great number of cases, the farmer, pushed for the most part for feed, had cut the crop before reaching maturity, and without keeping records of

weights. In many other cases, neglect, the encroachment of stock and other causes, had spoilt results from an experimental point of view. But in face of many failures, there still remained a number of fairly complete fields, due to the great interest and great care of a few fine men who recognised the value of the work attempted, and assisted us to their utmost. It is from their fields that I have gathered the facts I am going to place before you in this paper.

The accompanying plan shown will give some idea of the system adopted in laying out the fields. The whole field embraced, approximately, an acre of ground. There were three kinds of fields, laid out on exactly the same plan, but differing somewhat in the crops they carried.

SET X

PLAN OF EXPERIMENTAL FORAGE CROPS



NAMES OF CROPS SOWN

No. of Plot	Name of Crop	No. of Rows in Plot	Dist. apart of the Rows	Width of Plot	Length of Plot
			FEET	FEET	FEET
1	MAIZE	12	3	36	218
2	AMBER CANE	8	3	24	218
3	TEOSINTE	8	3	24	218
4	EGYPTIAN CORN	4	3	12	218
5	KAFFIR CORN	4	3	12	218
6	PEARL MILLET	4	3	12	218
7	MANGOLDS	12	2	24	218
8	BEET	10	[illegible]	24	218
9	RAPE	6	2	12	208
10	LUCERNE	20	1	20	218

The Plots as shown on the Plans are strips 218 feet long of different widths. On the Plan they are shown as running from East to West, and are numbered 1 to 10. Each Plot is sown with a different kind of seed. Crossing the plots from North to South are 8 manured and unmanured bands or strips all of equal width, viz. 27 feet 3 inches, and 200 feet long. These strips are marked on the plan A.B.C. up to H. B.C.E.F. and H. are manured each one differently. The strips A.D. and G. shown by the shaded portions of the plan are not manured. These unmanured strips serve for comparison with the manured strips. The manures that have been sent with this plan and are marked with the letters corresponding to those on the plan are very carefully spread broadcast on the strips, B.C.E.F. and H. before any of the seeds are sown and harrowed in. The seeds are afterwards drilled in across the strips. Thus the manures are applied in this direction ! The seed on each plot drilled this way —

I have called these X, Y and Z respectively. An examination of the X plan shown here will explain the system. It will be seen that on this field ten crops have been tested, side by side ; the crops are :—Maize, Amber cane, Teosinte, Egyptian Corn, Kaffir Corn, Pearl Millet, Mangels, Beet and Lucerne. There are twelve rows of maize, eight rows of amber cane, and a varying number of rows in the case of the other plants. The crops, in all cases, run in parallel rows east and west. Crossing these rows, at right angles, and running north and south, are shaded and unshaded strips extending, in each case from the top to the bottom of the field, and passing through all the crops tested. The shaded strips represent the portions which have received no manure,

JAPANESE MILLET, ELTHAM.

the unshaded strips the portions which have been manured, each naturally differently. These manured and unmanured lands I have called sections, and named them A, B, up to H. There are three unmanured sections for each crop, and five manured; and for the purpose of comparing yields you will see there is an unmanured section adjoining every manured. These manured bands were introduced into the field to get answers to questions of fertilization, to tell us to what extent the success of a crop depended upon soil conditions, apart from climatic. For answers as to the comparative yields between the different crops, say, between maize and amber cane, all we require to do is to take the average yield in each case of all the sections, and compare them, or we could take the average yield of the manured sections only in each case, and compare them, or the unmanured sections, or the maximum crops in each case. Such comparisons will be of great value, for we shall learn through them, whether maize produces a heavier bulk of forage, under similar conditions of growth, than amber cane, or amber cane than Kaffir corn, and so on. In the Y field, the system is the same, although the crops vary a little, and in the Z set the same thing occurs also. After this explanation then there will be little difficulty in understanding the comparisons I shall make later on, as also the figures of the following table showing the average yields of the different crops in a varying number of fields.

TABLES SHOWING THE AVERAGE YIELDS OF THE VARIOUS CROPS IN CENTRAL, SOUTHERN AND WESTERN VICTORIA.

		From section showing maximum returns.	Maximum Yield.	Minimum Yield.	Average yield per acre for 5 years at the New Jersey Experimental Station
		Tons.	Tons.	Tons.	Tons.
Maize ..	average of 25 crops	9·20	23·57	·67	10
Amber Cane	,, 21 ,,	11·09	22·07	1·24	10
Kaffir Corn..	,, 16 ,,	8·29	17·81	·77	8
Egyptian Corn	,, 15 ,,	6·39	14·62	·90	—
Japanese Millet (barnyard)	14 ,,	9·55	18·70	1·40	—
Pearl Millet	,, 6 ,,	13·91	28·19	·80	12
Planters' Friend	,, 6 ,,	12·55	34·69	1·67	—
Teosinte ..	,, 4 ,,	17·17	32·22	3·89	16
Rape (Dwarf Essex)	,, 20 ,,	17·18	47·44	·49	—
Kale ..	,, 10 ,,	9·02	21·50	·35	—
Lucerne ..	,, 3 ,,	2·44	6·19	·19	—
Cowpeas (clay)	,, 2 ,,	15·16	16·17	8·36	8
Mangels, Long Red	,, — ,,	—	31·50	—	—
,, Yellow Globe	,, — ,,	—	47·56	—	—
Pumpkins ..	,, — ,,	—	36·46	—	—
Beet ..	,, 156 ,,	14·72	—	—	—

A comparison of the figures will bring out great points of interest. The average yields will, doubtless, especially in the case of maize, appear small to those who have heard of the 50 and 60 tons to the acre supposed to be procurable from this crop. Such yields are, as a rule calculated from the results obtained from a few square feet, and are, in most cases misleading. As an average for even the soils of

Gippsland, we cannot look to yields of even half the quantity, although under the most favorable conditions, and on the first-class soils, far better results than such an average will be obtained. An examination of the maximum and minimum yield in each case will show the great variations of the soils experimented on. The most pleasant feature perhaps, in the experiments is the discovered possibility of rendering land considered almost worthless highly productive, and obtaining 10 and 12 tons or more to the acre of valuable forage, from a soil which, in its natural state, would not, perhaps, yield three. That even the average yields, however, are of a highly satisfactory nature becomes evident on comparing them with the averages obtained for five years at the New Jersey Experimental Station. Some most valuable soiling crop experiments have been conducted at this Station for a number of years. The results as indicating the possibilities of intensive farm practice under conditions, judging from a comparison of the results, certainly no better than our own, are of great value to every dairyman in Victoria. In their experiments a succession of soiling crops was obtained, which, in addition to a few pounds of fine feed per cow per day, supplied an equivalent of 50 full grown animals from May 1st to November 1st; 278 tons of forage were secured from 24 acres, 14 only of which were used the whole of the season. With the much larger yield obtainable over a considerable portion of Southern Victoria, the possibilities in this direction become very apparent. I have used the phrase Southern Victoria as including Gippsland and the Western district, as well as land adjacent to or slightly north of Melbourne. The fields were limited to this area.

The Objects of Forage Experiments.

Before proceeding further a short explanation of the objects of a forage experiment might be given. The object of a forage experiment should be to discover the crops giving the best succession, as well as those yielding the greatest bulk of produce of the greatest nutritive value. It is the second point we can first consider. The yields in the tables I have just called attention to, giving the average returns of a number of different crops are not comparative yields, as all these crops were not grown side by side. To get at the comparative yields of the different crops, to be able to say, for instance, whether maize grown on the same soil produces a heavier yield than amber cane, it is essential that they should be grown side by side, under exactly identical conditions of soil and climate. Now this has been possible in a great number of cases, and the results which have been obtained as bearing on the actual amount of produce obtainable from the different crops, under similar conditions are, in many cases, fairly conclusive and of great value. It would, I think, be advisable, in every way, to make the yield of maize the basis to which the yields of all other crops might be referred. For general forage purposes, it is as an annual crop, the one most extensively grown; in fact, little else, as an annual summer forage, has as yet been attempted in Southern Victoria. If it can be shown that, as an

SHOWING CUT IN THE MANURED SECTION OF MAIZE.

Photographed by Mr. Charles E. Price.

annual forage, maize will exceed, or even equal, both in yield of produce and the quality of its nutrients, all the forage plants tried, then there is nothing to justify the dairyman leaving a well-tried crop for others new to him. If, on the other hand, there are reasons to believe that certain other crops will, with an equal amount of labor, return him a greater bulk of fodder, of greater palatability and higher feeding value than the one he has been accustomed to grow, then it would most certainly be to his interest to introduce such crops on his farm.

Comparison of Results.

Maize Compared with the Sorghums.

A comparison of the following figures in which maize is compared with crops similar in character will offer facts for forming opinions in this direction :—

Maize Compared with Amber Cane, Kaffir Corn and Egyptian Corn.

	Based on the average yield of all the manured sections in each case				Based on the average of the Maximum Yields.			
	Maize.	Amber Cane.	Kaffir Corn.	Egyptian Corn.	Maize.	Amber Cane.	Kaffir Corn.	Egyptian Corn.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Average of 14 Fields ..	10·86	11·98	8·38	6·51	12·83	14·04	9·67	7·83.

Maize Compared with Planters' Friend.

	Maize. Tons.	Planters' Friend. Tons.	Maize. Tons.	Planters' Friend. Tons.
Average of 5 Fields ..	9·73	10·59	11·48	13·48.

Amber Cane Compared with Planters' Friend.

	Amber Cane. Tons.	Planters' Friend. Tons.	Amber Cane. Tons.	Planters' Friend. Tons.
Average of 6 Fields ..	11·22	12·37	13·54	16·45

It will be seen that for check purposes double comparisons have been made. That is the average yields of all the manured sections have been compared, as well as the average of the sections showing the maximum yield. As a general thing the figures of the second comparison are in agreement with those of the first. In the first line of figures of the tables, the comparative average yields of 14 crops of maize, amber cane, Kaffir corn and Egyptian corn are given. These crops were grown side by side on the different fields. The superiority of the amber cane and the maize over the Kaffir and Egyptian corn is so marked in both comparisons and was so pronounced in the appearance of the crops in the fields as to give grounds for believing that in Southern Victoria at any rate, these two latter crops have nothing special to recommend them to the dairyman except as a food supply for later periods. With respect to amber cane it will be found that in both sets of comparisons the average yield of this crop has exceeded by more than one ton to the acre those obtained from the maize crops.

A comparison of the average yield of five crops of maize with that of the same number of Planters' friend will also show a larger return for the second crop than for the first. That is that the yield of maize taking the average of five fields has been exceeded by that of the Planters' friend. This plant appears to have shown the greatest productive power of its class, for, as the comparison of the returns with amber cane show, there is a larger average taking the figures of five crops in the case of Planters' friend than even that of amber cane. These four crops, amber cane, Planters' friend, Egyptian corn and Kaffir corn, belong to the sorghum family. Through the occasional deaths of cattle partaking of this forage, sorghums are regarded by some with a little fear, and it must be admitted that in certain districts such a fear is justified, but in Southern Victoria, free from the checks in growth that occur in the North and which seem partly productive of the trouble, there seems no reason to me for anticipating drawbacks of this nature, and from the experience of the present year, both Planters' friend and amber cane are crops which in my opinion deserve a large share of attention on the part of the dairyman, always assuming they will be fed in an advanced stage of growth. In the first cut even the figures I have brought under your notice justify the belief they will produce yields equal to and probably larger than those of the maize, while in the opinion of some they possess other advantages as a fodder which lend an additional value. The opinions of a few growers in this respect will prove of interest. I might add that all the crops grown on the experimental fields were fed to cattle without the slightest ill effect. The two following letters from dairymen, give a very fair idea, I think, of the opinions entertained generally both in Gippsland and the drier portion of the Western district on the relative values of maize and amber cane.

Mr. Miller of Upper Maffra writes :—" In reference to giving you my experience regarding the fodders, maize was the only kind I tried before going in for this plot. My opinion of the plot is, amber cane is the best, as it gives the largest quantity and the cows ate it readily. They never left a single stalk, which was not the case in the maize. If sown early it would give a good second cut."

Mr. Gooding of Moe, in reply to my inquiry, places the amber cane as first in the list.

Mr. Enticott of Colac, writes :—" There being such a small quantity I cannot give any decided opinion on its feeding value as compared with maize, but I believe it will be a valuable fodder for this district to come in after the maize is finished. It stood the dry weather splendidly, the hot winds did not wither the tops as it did in the maize."

The Second Cut from the Sorghums.

Comparing the results of the single cut, there are two of the sorghums among the four tried which promise heavier yields than the maize crop, but in the case of the sorghums a second cut is easily obtainable in Southern Victoria. The following figures give the

JAPANESE MILLET, BAIRNSDALE.

results of a second cut from the field of Mr. Henderson, which might be regarded as typical of a large area of the better class soil of Gippsland.

	Results of Second Cut.		Total yield from the two cuts taken from maximum return in each case.	Maximum yield from Maize. The One Cut.
	Average of Manured Sections.	Maximum Yield.		
	Tons.	Tons.	Tons.	Tons.
Amber Cane ..	7·74	10·26	29·30	—
Kaffir Corn ..	8·46	10·36	28·17	—
Egyptian Corn ..	6·23	8·78	23·10	—
Planters' Friend ..	8·55	12·60	38·47	23 57

Considering then the large quantity of fodder procurable as a second cut from the sorghums, an additional reason becomes apparent for the dairyman giving some attention to the growth of at least amber cane and Planters' friend. Maize will always claim a superiority over all the sorghums in regard to its great earliness, but as a later fodder, giving a greater yield of produce, the two sorghums referred to will, I think, take an important place in the successional forage crops which should be grown as a regular practice on every farm in Southern Victoria, naturally on a small scale at first, and fed with caution.

Maize Compared with the Millets.

In addition to the proved suitability of Southern Victoria for the cultivation of the sorghum family, the experiments last year gave pronounced evidence of the splendid success that might be obtained from another class of plants—the millets, frequently grouped with the sorghums. Only two varieties—the Japanese and pearl millet—were obtainable on the Melbourne market at the time the experiments were undertaken, but the two, I think, have proved sufficient to pave the way for the introduction of a crop which will be taken up as a favorite throughout the whole of Gippsland and the Western District. Quick in growth, fine in foliage, and of great adaptability to a wide range of soils, even the poorest with manure, the Japanese millet especially will, I feel sure, rapidly catch on among dairymen. The pearl millet, while giving heavier yields, is much slower in growth, and a little more particular as regards its soil, but on the rich flats, with a sufficiency of moisture, yields of 30 tons and perhaps more to the acre might be procurable from the first cut. From the second cut very large yields ought also to follow. The Japanese millet in a favorable season, and got in early, would certainly give two and probably three cuts. Of the two varieties I should recommend it as the most generally suitable for Gippsland. A comparison of the yields of the millets with maize and amber cane will show the position the crops hold in productive power to these two crops.

MAIZE COMPARED WITH JAPANESE MILLET.

	Based on the average yield of all the manured sections.		Based on the average of the maximum yields.	
	Maize	Japanese Millet.	Maize.	Japanese Millet.
	Tons.	Tons.	Tons.	Tons.
Average of 9 Fields. ..	8.95	9 53	10·59	11·48

AMBER CANE COMPARED WITH JAPANESE MILLET.

	Amber Cane.	Japanese Millet.	Amber Cane.	Japanese Millet
	Tons.	Tons.	Tons.	Tons.
Average of 9 Fields. ..	9·50	8·79	11·74	10·43

MAIZE COMPARED WITH PEARL MILLET.

	Maize.	Pearl Millet.	Maize.	Pearl Millet.
	Tons.	Tons.	Tons.	Tons.
Average of 6 Fields ..	12 07	12 73	14·60	14·72

AMBER CANE COMPARED WITH PEARL MILLET.

	Amber Cane.	Pearl Millet.	Amber Cane.	Pearl Millet.
	Tons.	Tons.	Tons.	Tons.
Average of 6 Fields ..	13·72	12·73	15·90	14·72

AMBER CANE COMPARED WITH TEOSINTE.

	Amber Cane.	Teosinte.	Amber Cane.	Teosinte.
	Tons.	Tons.	Tons.	Tons.
Average of 4 Fields ..	13·79	16·78	15·10	19·77

It will be noticed that the amber cane has in both cases given heavier yields than either of the millets, while the maize appears to have been slightly exceeded in the yields by both. This, I think, on the better class of soils would not, as far as maize and Japanese millet are concerned, be a general thing. A number of these returns were secured from light soils of no great natural fertility, and on such soils, with manures, the Japanese millet particularly has done better than the maize. As a general thing heavier yields will, I think, be obtained from maize than from Japanese millet as a first cut. On rich, moist flats the pearl millet may exceed the maize, but is slow of growth and late in maturing. An objection raised by one farmer is that the cows do not take readily to it. Fed on amber cane and maize, doubtless some little time would be required to acquire a taste for a different fodder, but I hardly think the objection will be found a general one. The Japanese millet, apart from its heavy yield, is exceedingly quick of growth, appears to be relished by all kinds of stock, is fine in the stalk, makes good hay, and put in early ought to give two, perhaps three, cuts during the season. It should be cut just as the seed heads are appearing.

THE RETURNS FROM TEOSINTE.

It will be noticed that the tables show the returns from another crop—teosinte, a crop very similar in appearance and character to the sorghums. It has the reputation, under favorable conditions, of producing the largest bulk of fodder of all forage plants. The yields it

TWO ROWS OF PEARL MILLET, MOE.

RAPE, BAIRNSDALE.

will be seen, taking the average of the four fields, are a good deal in excess of the amber cane. It is, however, very slow of growth, requires plenty of moisture, and is about fit for cutting just before the first frosts. Its only use, I think, would be for silage. It will not, I think, catch on generally as a forage.

Other Crops.

Rape.

We have just dealt with a number of crops of similar characteristics, but a number of other crops of widely different characteristics, although of quite equal importance, were also included in the season's tests. No crop in the whole series tried proved such a success as rape. The enormous yields generally secured came as a surprise to the majority of growers, and it will not, I think, be long before the value of the crop is generally recognised throughout Southern Victoria, where it appears to succeed admirably over a wide range of soils. The following figures will show the comparative yields with maize:—

	Based on average of all manured sections.		Based on average of maximum yield.	
	Maize.	Rape.	Maize.	Rape.
	Tons.	Tons.	Tons.	Tons.
Average of 16 Fields ..	8·15	15·21	10·32	18·50

In the figures I called attention to in the early part of the paper it was shown that the yield of 17·18 tons was secured as an average of twenty fields. Among the twenty crops grown there were in six cases returns exceeding 30 tons to the acre, and in three other cases yields exceeding 20 tons. The maximum crop grown was at the farm of Mr. Gooding, of Moe Swamp, where the enormous yield of nearly 47½ tons per acre was obtained on one of the manured sections. The minimum yield obtained was half a ton to the acre from poor, sandy, and unmanured country, which by manuring produced as a first cut over 5½ tons to the acre. The results obtained in the fertilization of this crop have been regular and general. The enormous growth possible in the short period of time, seems to require for its maximum development an abundance of readily available plant food, and there is no crop that has so readily responded to the application of fertilizers. On soils of a poor nature, yielding as a return in their natural state a ton or less of forage, increases of 9, 10 and 11 tons have been secured over and above this. As a food for milking cows the rape has been condemned on account of the taint it imparts. The opinions I have got from dairymen vary greatly on this point, and much of the trouble probably rests in injudicious methods of feeding; but even admitting such a fault, the value of the crop in other directions far outweighs this. It produces an abundant flow of milk, and as a food for sheep, pigs, and poultry is held in the highest esteem in Europe. The experiments of the present year justify my

advising farmers to go in for the crop extensively. Kale, which was also tried, succeeded well, but the impossibility of having an officer present on every occasion to strip the leaves as required, prevented full returns being obtained.

Pumpkins.

In addition to the crops already dealt with there were a few fields in which pumpkins, mangels, cow peas, soy beans, and Florida beans were included. In only one instance were returns for pumpkins and mangels procurable. In the case of cow peas the returns from two crops were obtained, while the few fields of soy beans and Florida beans failed almost entirely. The returns from one plot of pumpkins were so good as to suggest the advisability of a far greater attention being given to the crop especially on lighter soils, which seem to show a very marked response to manures in the case of this crop. The difference between the yields of the unmanured and the manured sections was more striking in the case of this crop than any other tried. On the unmanured section a yield at the rate of 4·86 tons only to the acre was obtained, while the manured section, showing the maximum returns, gave figures exceeding 36 tons. There was evidence in the earlier stages of growth of the section with the complete manure even considerably exceeding these figures; but a rather long spell of dry weather caused, in this instance, many of the fruits to fall off, appreciably reducing the yield. The pumpkin is certainly a watery food, but taken in conjunction with the immense yields obtainable, the chemical composition is such as to indicate that it is a fodder by no means to be despised, and one for which a special purpose might also be found on every farm. The analyses of the pumpkin from American sources show the following figures :—

	Amount of Digestible Nutrient in 100 lbs.				
	Water.	Protein.	Fiber.	Sugar, Starch, &c.	Fat.
Pumpkins	90·90	1·20	1·10	2·90	·30
Mangels	90·90	1·10	·50	4·20	·10

But the succulency of a food often increases its nutritive value beyond that ascribed on the basis of chemical analysis.

Mangels.

The mangel is a crop whose qualities are fairly well-known to every farmer. To parade figures showing the very large yields obtainable from the crop would serve little purpose. Its large yielding power is generally recognised. But the advisability of experiments to determine the varying yields procurable under similar conditions of growth from new and untried varieties is of course very patent. In the one test made where the Long Red and Yellow Globe were grown side by side, the advantage seemed very much in favour of the Yellow Globe. The maximum yield in the Long Red figured

COW PEAS.

out at the rate of 31·31 tons per acre. In the case of the Yellow Globe a return at the rate of 47·56 tons per acre was secured. Both crops were harvested as early as March. Left till full maturity in June these yields would probably be increased by at least 50 per cent. The crops were grown on upland soil of no marked friability. On a second field, located on a friable peaty flat of easy penetrability, the Long Red had developed to a very considerable depth in the soil, and appeared to give a markedly superior weight to the Globe. Unfortunately actual weights were not secured, but appearances seemed to indicate that the comparative yielding power of the two varieties is largely a matter of physical soil conditions. On the shallower and less friable soils the Yellow Globe will probably show the maximum yield, while the Long Red will possibly show to advantage on soils of the other class referred to.

Protein Yielding Crops.

Now, nearly all the crops dealt with may be considered carbonaceous in character—that is, they are not crops containing large amounts of protein. They may serve as the bulk of cattle food, and supply the starch, the sugar, and the fat required, but do not contain amounts of protein sufficiently large to maintain our cattle in the most profitable condition. Now in addition to the raising of such crops as those just dealt with, the dairyman should give some attention to crops rich in protein. To feed exclusively with the foods just dealt with, in which the amount of digestible protein is so small, means less beef and less milk than that obtained under a properly balanced ration. I am not going into the question of the principles of feeding. My colleague of the Dairy Branch, Dr. Cherry, will instruct you in this direction, but I have mentioned a few facts only to bring out the necessity of raising all the protein we possibly can on the farm. Experiment has shown that a dairy cow per day and per 1,000 lbs. of live weight will require some 24 lbs. of dry matter, including 13½ to 15 lbs. of sugar, starch, fat, &c., and 2 to 2½ lbs. of digestible protein, and that the amount of the sugar, starch, fat, &c., in this ration should exceed the digestible protein present by 5½ to 7 times. An examination of most of the crops we have dealt with would show that the relative amount present of protein to the non-protein is considerably smaller than this. We effect a saving in the purchase of this necessary protein if we can produce a large part of it in the crops we raise on the farm. Now there are crops which enable us to do this. The value of lucerne and clover is well recognized in this direction, but the list of such crops requires extending. With this aim in view experiments on a limited number of fields were attempted last season with the cow pea, the soy bean, and the Florida bean. The first two crops are extensively grown and highly thought of in America. They are frequently grown together with some of the carbonaceous feeds, such as sorghum, supplying as a mixed food the protein in which the sorghum is deficient. The seed, however, of both the cow pea and soy bean appears particularly sensitive to excess of moisture and temperature conditions. The heavy falls of rain and the low temperature following the break up of the drought last spring came just after

the principal sowings of these crops had been made, and the germination, unfortunately, was not sufficiently good to satisfy the farmer who, in most cases, precipitately ploughed the crops in. In only two cases out of about ten fields were results obtained from the cow pea plots. In the case of the soy bean the stand was too poor to admit of harvesting as a forage crop. The individual plants, however, gave particularly heavy yields of grain as illustrated. The crop of cow peas grown on the farm of Mr. Grant produced at the rate of 15·16 tons of forage to the acre. At the Tobacco Farm, at Edi, a maximum yield of 16·17 tons was obtained. There seems every reason to my mind for believing that, sown fairly late in the year when the soil has warmed well, the cow pea will do well in Gippsland and the Western district. But we require to largely test the many different varieties of this plant. There should be some among the many which ought to prove a valuable protein producing summer forage, grown preferably not alone, but together with amber cane, or one of the other highly carbonaceous plants. The same remarks might also apply to the soy bean. The tests so far carried out, however, in both cases were not sufficiently numerous or conclusive to warrant advising the farmer as yet to take either crop up extensively.

The Beet.

Quite apart from the forage experiments proper, of which I have been dealing, beet seed, sufficient in most cases for one acre, was supplied to 381 farmers. Of this number 180 fields were put in by my drill officers. I had warmly advocated this crop in my lecture before the conference of the Rural Producers' Association, at Shepparton, and it is most satisfactory for me to know that the crop has generally done so well. It is put forward as no new discovery that it is a forage crop of value, but the recognition of its value as such in Victoria is certainly of recent origin. In France beets for forage purposes are considered worth 75 per cent. as much as the price paid for sugar-making. Twice as many beets are there grown for stock food as for sugar. The average yield of 156 fields in Gippsland and the Western district was 14·72 tons of dressed roots nearly. Counting the weight of tops and collar that were removed in the dressed beet, the yield might, perhaps, be brought up to 18 tons or more. It is stated that European feeders "consider these tops worth as much as the best hay, pound for pound."

The Results of Fertilization.

The manures used on the different sections of the fields were as follows :—

Section	B.—2	cwt.	Ordinary Superphosphate
,,	C.—2	,,	,, ,,
	1	,,	Nitrate of Soda
,,	E.—2	,,	Ordinary Superphosphate
	⅔	,,	Potash Chloride
,,	F.—2	,,	Ordinary Superphosphate
	1	,,	Nitrate of Soda
	⅔	,,	Potash Chloride
,,	H.—2	,,	Ordinary Superphosphate
	1	,,	Nitrate of Soda
	3	,,	Gypsum

PEARL MILLET, UPPER TAMBO.

In introducing the manured strips into the experimental fields it was hardly expected that exact data would be obtained on questions of fertilization. Little more than indications were expected as to probable soil deficiencies and the extent to which these might influence the adaptability of the various districts for the different crops tested. The area of each section both manured and unmanured was too small to be sufficiently free from those great natural variations in the character and fertility of even adjoining soils to give reliable figures as to the effect or otherwise of manure. Where much larger areas are used for comparison, the effects of such soil irregularities are naturally considerably reduced; but although the fertilization returns from the forage fields may suffer from these drawbacks and show in cases apparent irregularities the results have nevertheless given valuable information as to the manurial requirements generally of each crop, and the approximate increase in yields at least we might expect from appropriate fertilization. The following table will show the average yields of all the unmanured sections of each crop, the average yield of the various manured sections and the increases due to the use of these manures. In the case of each crop the returns from a few fields shewing pronounced irregularities, due to known causes, have been omitted from the table.

Returns Showing Average Yields of the Various Crops with Increases Produced by Manures.

	Yields per acre in tons.						Increase due to Manures.				
		B.	C.	E.	F.	H.	B.	C.	E.	F.	H.
	Average of unmanured sections.	Phosphoric Acid.	Phosphoric Acid and Nitrogen.	Phosphoric Acid and Potash.	Phosphoric Acid, Nitrogen and Potash.	Phosphoric Acid, Nitrogen and Lime.	Phosphoric Acid.	Phosphoric Acid and Nitrogen.	Phosphoric Acid and Potash.	Phosphoric Acid, Nitrogen and Potash.	Phosphoric Acid, Nitrogen and Lime.
Maize (Avg. of 22 crops)	6·91	7·83	7·97	8·17	8·41	7·77	·92	1·06	1·26	1·50	·86
Amber Cane ,, 16 ,,	8·85	10·18	10·60	9·82	11·17	10·42	1·33	1·75	·97	2·32	1·57
Kaffir Corn ,, 11 ,,	5·79	6·99	7·13	6·32	6·60	6·60	1·20	1·34	·53	·81	·81
Egyptian Corn 9 ,,	5·09	5·88	5·91	5·60	6·16	5·35	·79	·82	·51	1·07	·26
Planters' Friend 4 ,,	5·62	6·29	6·37	6·80	5·69	6·54	·67	·75	1·18	·07	·92
Japanese Millet 13 ,,	6·14	7·99	9·12	8·06	9·12	9·04	1·85	2·98	1·92	2·98	2·90
Pearl Millet ,, 6 ,,	10·51	12·51	13·91	13·11	12·84	11·47	2·00	3·40	2·60	2·33	·96
Teosinte ,, 3 ,,	10·23	14·66	13·69	12·03	17·26	13·89	4·43	3·46	1·80	7·03	3·66
Rape ,, 19 ,,	12·34	14·78	15·57	15·89	17·06	15·98	2·44	3·23	3·55	4·72	3·64
Kale ,, 9 ,,	5·29	7·22	8·55	7·38	8·69	8·77	1·93	3·26	2·09	3·40	3·48
Lucerne	1·76	2·44	1·89	1·82	2·30	1·81	·68	·13	·06	·54	·05

An examination of the figures will show that two facts stand out with great clearness. The first, that phosphoric acid on section B has shown marked increases in yield over the unmanured sections, and that in section C where an addition of nitrogen to phosphoric acid has been made, still larger increases have been obtained than where

phosphoric acid only has been applied. These two facts are clearly illustrated in the following first three columns of figures taken from the tables above :—

	Yields per acre in tons.			
	Unmanured.	Phosphoric Acid.	Phosphoric Acid and Nitrogen.	Phosphoric Acid, Nitrogen and Potash.
Maize	6·91	7 83	7·97	8·41
Amber Cane	8·85	10 18	10·60	11 17
Kaffir Corn	5·79	6·99	7·13	6·60
Egyptian Corn	5·09	5·88	5·91	6·16
Planters' Friend	5·62	6 29	6·37	5·69
Japanese Millet	6·14	7·99	9·12	9·12
Pearl Millet	10·51	12·51	13·91	12 84
Teosinte	10·23	14·66	13 69	17·26
Rape	12·34	14·78	15·57	17·06
Kale	5 29	7·22	8·55	8·69
Lucerne	1·76	2·44	1·89	2·30

In nine out of the eleven crops the nitrogen and phosphoric acid returns are greater than the phosphoric acid only. In the two other cases, where this is the reverse, one crop it will be observed is lucerne, a crop where an increase from nitrogen manuring could not be expected as a general thing; while in the case of the other crop, teosinte, there are reasons to think, judging from the returns on section F, that an irregularity might be responsible for the smaller yield. A comparison of the fourth column of figures with the third would appear to indicate that the further addition of potash to the phosphoric and nitrogenous manure used in the case of the third column has shown some effect on six out of the eleven crops, but that the additional increase in yield produced by this ingredient has been generally speaking not a marked one. These results are in every way confirmatory of those obtained from a large number of hay crops grown last year on much larger experimental plots in the South of Victoria. They point, as the results of those plots did, to phosphoric acid as the prominent soil deficiency, nitrogen as the second active ingredient in the production of increased yield, and potash as a manurial requirement that might almost be neglected on the better class lands, but that would require consideration on the lighter sandy soils of lower fertility. The results of the experiments referred to are given below :—

EXPERIMENTAL HAY CROPS GROWN IN FIVE DIFFERENT DISTRICTS OF SOUTHERN VICTORIA

	Increases in yield produced by different manures.			
	Phosphoric Acid.	Phosphoric Acid and Potash.	Phosphoric Acid and Nitrogen.	Phosphoric Acid, Nitrogen and Potash.
Average of 30 experimental fields in tons	·65 tons.	·87 tons	1·20 tons.	1·27 tons.

Dates of Sowing and Harvesting.

The dates of the sowing of the various crops will vary a good deal for different parts of Gippsland and the Western district. The

liability or not to late spring frosts will largely determine the question. The order in which the crops may reach maturity and the time taken to reach maturity will also differ somewhat in different localities. Generally speaking the principal crops may reach the proper cutting stage in about the following order:—Rape, Maize, Japanese Millet, Amber Cane, Kaffir Corn, Egyptian Corn, Pearl Millet, Planters' Friend, Teosinte. The returns from the field of Mr. Henderson, of Bairnsdale, in which the date of sowing and the date of harvesting of the different crops are given, will indicate approximately the position the crops hold to each other in regard to earliness in reaching the proper cutting stage. All the crops in this field were sown on the 20th of October. The maize, Japanese millet and rape were cut on the 13th January, 85 days after sowing. The maize was well out in tassel and might have been cut a little earlier. The rape was also a little too advanced. The amber cane was cut on the 31st of the same month, 103 days after sowing. The maximum yield in the case of Kaffir corn and Egyptian corn appeared to be reached about a week later in the first plant and ten days to a fortnight in the second. The Planters' friend showed to best advantage three to four weeks after the cutting of the amber cane. Teosinte on this field was cut on the 25th March, 158 days after sowing. The majority of the forage fields were sown between the 15th October and the middle of November. With the exception of the cow pea, soy bean, and Florida bean, the earlier date generally speaking gave the best results.

Returns from a few Individual Fields.

So far we have only dealt with average results, calculated from results obtained from all classes of soils. As indicating what might be expected from each class of soil, the individual returns of four fields representative of soils that might be classed as very poor, medium, good upland and good flat, deserve careful consideration.

RETURNS FROM FOUR FORAGE FIELDS REPRESENTATIVE OF SOILS CLASSED AS VERY POOR, MEDIUM, GOOD UPLAND AND GOOD FLAT.

	Average yield of Unmanured Sections.				Average yield of Manured Sections.				Maximum Yield.				Minimum Yield.			
	Poor.	Medium.	Good Upland.	Good Flat.	Poor	Medium.	Good Upland.	Good Flat.	Poor.	Medium.	Good Upland.	Good Flat.	Poor	Medium.	Good Upland.	Good Flat.
	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
Maize	3·31	10·91	19·21	13·53	6·06	12·31	19·59	11·30	9·67	14·54	23·57	15·34	2·82	10·91	15·91	12·67
Amber Cane ...	3·16	9·33	13·27	16·39	4·79	12·25	18·10	20·44	5·76	15·29	18·97	21·78	2·29	9·33	11·74	16·98
Planters' Friend ..			18·73				18·96				20·53				13·39	
Kaffir Corn	2·78	7·26	13·49	12·31	4·74	10·79	13·05	14·59	5·56	11·92	17·81	16·07	2·70	7·26	9·17	11·59
Egyptian Corn ..	1·38	5·18	10·28	10·82	2·13	5·72	11·66	12·34	3·03	6·35	14·32	14·62	1·23	5·18	7·52	10·35
Pearl Millet.. ..	1·31	6·30		23·07	4·18	13·86		24·29	5·14	15·04		28·19	·80	6·30		20·04
Japanese Millet ..		8·83	14·20			15·95	16·10			18·18	18·70				9·79	
Teosinte	4·56		20·96	17·42	6·73		20·39	29·08	9·09		24·75	32·22	4·56		16·91	16·94
Rape	1·09		26·24	44·33	4·25		24·20	44·02	5·59		31·41	47·44	·50		15·91	36·48
Kale		9·58	11·18			10·49	10·04			13·79	11·95			8·81	8·33	
Lucerne	·31			4·08	·43			4·88	·76			6·19	·19			3·86
Mangels																
Pumpkins		4·86				20·73				36·46				4·86		
Cow Peas		8·36				11·21				15·16				8·36		

It will be seen that four comparisons have been made on each class of soil. That is the yields of the unmanured sections in each case have been compared, the yields of the manured sections, the maximum yield and the minimum yield. In the case of every crop tried on the poor and medium soils, the average yield of the manured sections is larger than that of the unmanured, in most cases appreciably so. The extent to which manures have acted on these soils becomes more evident on comparing the yields of the unmanured sections with the maximum yield, in every case a manured section. This comparison is made in the following figures:—

YIELDS PER ACRE IN TONS.

	Poor Soil.		Medium Soil.	
	Unmanured.	Maximum Manured.	Unmanured.	Maximum Manured.
Maize	3·31	9·67	10·91	14·54
Amber Cane	3·16	5·78	9·33	15·29
Kaffir Corn	2·78	5·56	7·26	11·92
Egyptian Corn ..	1·38	3 03	5·18	6·35
Pearl Millet	1·31	5·14	6·30	15·04
Teosinte	4·56	9·09		
Japanese Millet ..			8·83	18·17
Rape	1·09	5·59		

The increased yield shown by the maximum return over that of the unmanured sections is in both soils very considerable and certainly justifies a liberal use of fertilizers on such soils. These experiments I think open a new chapter of possibilities in regard to large areas of country in Gippsland at present considered worthless. The soil classed as poor is typical of a very large area extending, I am told, from the Tambo to the Snowy River. The prevailing vegetation is stringy bark, honeysuckle and bracken. Yields of over 9 tons to the acre of maize and teosinte have been obtained from this soil. Lucerne gives promises of doing well and rape has afforded as a first cut over 5½ tons of valuable forage to the acre.

The Effect of Manures on First-class Soils.

This will vary a good deal owing to a number of circumstances. The earliness of the crop, the retentive power of the soil for moisture, and the rainfall, will all exert a large influence in this direction, larger perhaps in the case of the better class soils owing to the heavier yields and their larger moisture requirements than in the poorer. Instances were frequent last year on many fields where certain manures up to a given period had produced great differences in growth even on what might be considered first class soils; but at a later period when the moisture reserve from the winter rains had diminished, it was these crops especially showing the extra growth which appeared to be the most seriously affected. Weights taken from such plots after receiving the check in growth were in many cases considerably behind those from adjoining plots, which a week or fortnight before had shown

perceptibly lower yields. The moisture demands of the larger growth had exceeded the available soil supply in the one case, while in the second, demand and supply were sufficiently balanced to prevent injury. This is one of the many causes introducing those irregularities and contradictions so frequently found in the results of manure test plots. As a rule, even on the better class soils, crops making rapid growth and reaching maturity early will show increased yields from the use of manures owing to a sufficiency of soil moisture for the full operative effect.

With the later crops, the character of the season principally will determine the operative action of a fertilizer. Rape and Japanese millet as the earliest crops available will probably show the largest effect of manuring. Maize will possibly show a fair response, but with most of the other crops it is questionable whether differences deserving consideration will be observable.

The Opinions of Dairymen on the Various Crops.

The point which up to now has received special prominence in this paper has been the bulk of fodder obtainable from each crop. Considerations of the palatability of each forage plant, its nutritive value, suitability for different periods of the season or different localities have not been dealt with. For answers to these questions we are dependent principally upon the verdict of the dairyman. The opinions of the dairymen vary somewhat with regard to certain crops, but there appears a great unanimity with respect to others. A few of these opinions have already been given. Extracts from a number of letters from the more prominent growers are given here. It is not to be understood that I agree in all respects with the opinions expressed by these growers.

Japanese Millet.

Mr. Grant, Upper Tambo :—"My opinion of maize as a green fodder is soon stated. I would not grow it again because Japanese millet planted on the same day, cultivated under the same conditions and cut the same day, gave a greater weight in the first cut, and was afterwards cut twice. With maize the cows did not increase as much in milk as with the Japanese millet."

Mr. Crowe, Eltham :—"The Japanese millet I like very well and will certainly put in some of it next season. The cows eat it well and also milk well when fed on it."

Mr. McGrath, Loch :—"The other forage crops, after beet, I would class as follows—First, Japanese millet which, if sown early, in my opinion has no equal as a summer feed for dairy cows as it could be fed off twice and then let go for seed and hay as it will do for both."

Amber Cane.

A few opinions have already been given in the early part of this paper on amber cane. In addition to these, Mr. Grant writes :—"In

respect to the feeding qualities of the various fodders, I must say I believe very much in amber cane, I find that my cows are very fond of it and that they milked well while being fed on it, giving an increase of butter. I think that it is better than maize, as it stands the hot and dry weather, while the maize withers."

Mr. McGrath :—" Amber cane I would class as equal to maize for autumn feed, although my cows milk better on it than they do on maize, and unlike some others I have never had any trouble with it in feeding to the cows, as I never feed it until the seed is well out."

Mr. Grant :—" This plot has done very well and gave a good weight of green fodder. It was cut on the 4th March and has since made a growth of fully 3 feet to 7th May, and as it has tillered out there is again a good weight of fodder."

Mr. Gooding, Moe :—" With respect to the forage crops I will place them in this way—1st amber cane, 2nd Egyptian corn, 3rd Kaffir corn, 4th teosinte, 5th maize, 6th pearl millet. You see I have placed the maize fifth because you only get one crop, and a great amount of labour in cutting the maize, as we feed off the others and get two and sometimes three crops off them."

Steele Bros., Rosebrook :—" With regard to feeding qualities now that we have fed all the crops, we consider the amber cane comes first of all the fodder plots as it would weigh much heavier than the others, and the stock seem to eat it with more of a relish. One advantage with the amber cane is that it will stand much longer than the maize without drying off and of course that is a great advantage."

Planters' Friend.

Mr. Henderson, Bairnsdale, places this crop first. Mr. Crowe of Eltham reports the Planters' friend did very little good here. Mr. Grant of Upper Tambo writes :—" This is a crop I intend to grow next year. It is still green and succulent, May 1st, and all stock are fond of it. It has given good results in all ways, I have used it for horse feed, or cut it into chaff for calves that are hand reared. When fed to cows it gave a good increase of milk." Mr. McGrath of Loch writes :—" My second choice after Japanese millet is imphee or Planters' friend which for later feed is undoubtedly better than maize as the frost does not affect it nearly as much as maize."

Teosinte.

Most of the growers as yet are a little shy in expressing opinions on this crop, owing I think to its very slow growth. On very many farms it has undoubtedly proved a failure. On others, however, exceedingly heavy yields have been obtained. The following are some of the opinions received :—Mr. Grant, who had one of the most complete and carefully tended fields of the lot, writes :—" This crop ranks very high indeed in my estimation. The seed was sown on the 16th October. When the hot weather came, in the middle of January,

TEOSINTE (2 ROWS) MOE.

the teosinte grew very quickly and continued to do so in spite of the fact that the official record of the rainfall during January, February and March for this district was the lowest for many years. It will grow during hot dry weather, which is a great consideration. When the stems are more than an inch thick they are so tender and succulent that young calves about two months old eat it readily. One trouble a dairyman has in many parts of Victoria is that about the time his hand fed calves are fit to wean, the grass, although plentiful, is so dry that weaned calves will not thrive until the autumn rains come. Teosinte will remedy that for I have proved they will do well on it."

Mr. McGrath at the time of writing had not commenced feeding this crop. He writes:—"There is one of your fodders that I have not as yet had experience with, viz., teosinte. It is now (May 7th) growing very rapidly and is just coming out into flower. It is now over 6 feet high. I intend giving it another trial by sowing it earlier next season."

Mr. Miller of Upper Maffra writes:—"The stock eat it readily, but judging by this trial it would hardly give a large enough quantity and is also very coarse."

Mr. Gooding of Moe writes:—"In regard to the teosinte I believe it to be the best of the lot in a dry climate, where it could be sown about the end of August, as it would give a great quantity of green feed and the cows are more fond of it than any of the other crops. I cannot quite understand it, it shows no sign of going to seed. It is now about 9 feet high and looks beautiful. If it could come as quick as the other crops I would place it first."

Kaffir Corn, Egyptian Corn and Pearl Millet.

Varying opinions are expressed by the dairymen with regard to Kaffir corn, Egyptian corn and pearl millet. The opinions generally entertained are that they are inferior to the crops just dealt with. The second crop, however, appears to be better in the case of the Kaffir corn than in amber cane. Mr. McGrath is of the opinion that neither Kaffir corn nor Egyptian corn is suitable for his district. Mr. Grant reports that the Egyptian corn did not do well in his district. The Kaffir corn, however, he intends to grow in preference to amber cane owing to its larger second growth and as he thinks better feeding qualities. Mr. Crowe thinks the butter was not so sweet when the cows were fed on Kaffir corn and Egyptian corn as with amber cane, but reports that the cows showed a liking for the crops. The pearl millet in Mr. Grant's opinion is a very good fodder, well liked by cattle and yielding a good weight per acre, but in his estimation it falls behind the Japanese variety both in yield and quickness of growth.

Cow Peas, Soy Beans and Florida Beans.

The field of Mr. Grant was the only one in which these three crops were included. His report is therefore of exceptional value. I give his opinions on each crop. "The cow pea plot grew well all through

the hot dry weather and kept beautifully green until the occurrence of a very slight frost, which turned the tops black. A few blossoms only appeared but no peas formed. The cattle did not like the peas at first and some cows would not eat them even when chaffed and mixed with Planters' friend. Some of the cows afterwards acquired a taste for them. I would like to try an earlier kind next season. The horses ate them very well."

"The soy bean is a crop I hope to give a good trial next year as I have saved enough seed to plant a good area. I think the reason of a lot of the seed not germinating this season was that the ground was too wet and cold when sown; but what did grow gave great yields of beans for the size of the plant."

"The Florida beans did not grow well until the hot weather, when they grew rapidly. Some plants had a few flowers on but no beans. There were not enough of the plants to judge of their feeding value."

The Beet.

The opinions from dairymen on the value of this crop are numerous and almost unanimous. In a few cases reports have been received of cattle refusing to touch the crop, but nearly every letter received bears testimony in a very opposite direction. The great success of the crop justifies the inclusion in this paper of the numerous opinions which follow:—

Thos. J. Martin, Newry:—"I have been using sugar beet for four years as a fodder for stock. I find it far superior to any other fodder. Cows give a better test, and put on condition at the same time. Pigs fatten readily on the beets and water, and it is also good for horses, sheep, and poultry, and I always intend to grow it for my stock as it is always ready when other fodders have dried off."

J. Shugg, Sale:—"I have been cultivating sugar beet ever since the inauguration of the industry, and am thoroughly convinced of its good feeding qualities as a fodder for all kinds of stock. My test has always been the highest when the cows are being fed on the sugar beet."

H. Miller, per R. Dawe, Maffra (Upper) West:—"I have used sugar beet for several years, and find it superior to any other fodder for cows or pigs. It increases the quantity and quality of milk and keeps them in good condition also."

James Carr, Stratford:—"I have grown sugar beet for the last five years, and have found it a very good fodder for all stock, being far better than mangels or any other root crop. Pigs fatten quickly on it, and cows increase in both quantity and quality of milk, while being fed on it. Horses, sheep, calves, and poultry are very fond of it."

A. S. Elwell, Newry:—"My opinion of sugar beet is that it is the best fodder you can grow for pigs, sheep and cattle. It yields milk better than any other fodder I have grown or seen grown, and half

FIELD OF COW PEAS, UPPER TAMBO

the quantity does them. Maize I have grown, but the grasshoppers eat it off and spoil the crop, but with beet I have always had a crop, and shall always grow it."

William Brown, Briagolong :—" I have grown sugar beet for the last three years, and I find it a splendid fodder for all kinds of stock. It is better for milking cows than either maize or mangels and very fattening for pigs."

J. H. Edwards, Bushy Park :—" I have been growing sugar beet for eight years. I consider it a very valuable fodder for all stock. It has given me great satisfaction at all times, both as cattle and pig feed, and it comes in when maize and other green fodders are gone."

A. Hamilton, Stratford :—" I find sugar beet to be an excellent food for pigs and other stock, and it is more particularly valuable as it comes in at the season when other feed is scarce. I have had it sliced and kept it as ensilage to use in the summer or any time wanted, and find it keeps perfectly. This adds very greatly to its value."

Reuben Blundy, Briagolong :—" I have been growing sugar beet ever since the Maffra factory started, and I consider it the best fodder a dairy farmer can grow, being far superior to all others. It gives a heavy yield of fodder ; is always fresh, and you can always have it when most other fodders are out of season. All stock are very fond and thrive well on it. It is excellent as a milk, butter, and fat producer, and I always intend to have it growing for my stock."

Chas. Widdis, Traralgon :—" I have been growing sugar beet for five years, and consider it a splendid fodder for all kinds of stock. I have fattened pigs for market for several years on it, with good results. I consider it far superior to maize or mangels or other root crops, and I never will be without it while I can get seed. I consider it the best fodder a farmer can grow for his stock."

Allen Walker, Boisdale :—" I have grown sugar beet last year for the first time, and I found it a splendid fodder for cows in winter, far superior to any sort of green fodder at that time of the year. The cows milked well on it, and it also keeps them in good condition. I intend to have a plot of it every year."

W. Matthews, Traralgon :—" I had half an acre of beet last year, and fed my milking cows on it through the winter months. They increased considerably in their milk after the first week of feeding. I think very highly of it as a fodder for milking cows. I had cows and calves in very poor condition, and after feeding a couple of months on the beet they were nearly fit for the butcher, and milking splendidly."

William Thomson, Cowwarr :—" I have been growing sugar beet for two years, and in my opinion it is the best fodder for stock that can be grown in the way of root crops. It not only increases the yield of milk but improves the quality as well, and keeps the cows in good condition as well. For pigs it is the best fodder I have ever grown."

Such opinions are those of dairymen, and ought to carry some weight. They are men who have had experience with the mangel, and have evidently found by experience that there are qualities in beet, notwithstanding its smaller yield, which attach to it a value above and beyond that of the first crop. Undoubtedly one of the first recommendations is that it comes in at a time when most of the fodders usually grown are done. I can recommend the crop in full confidence to the dairymen.

Food Values of the Various Crops.

It would have been of interest as well as of value to have analysed the various fodders from different parts of Victoria, but the long distance of the fields from the laboratory, and the difficulties of transport prevented accurate work of this kind being carried out. It will be understood that it is not the bulk alone of a fodder which constitutes its value, but the amount and the composition of the dry matter it contains. Different plants at the time of cutting show great variations in the percentage of dry matter they contain. The following tables taken from American sources will give you some idea of the variations in this respect as well as the differences in food value of a number of the crops grown. I wish you to regard them, however, as applicable to our conditions more as approximations than as absolutely correct estimates.

Total Dry Matter and Digestible Nutrients in 10 tons of Green Forage from Each of the Following Crops :—

	Dry Matter. lbs.	Protein. lbs.	Carbohydrates. lbs.	Fat. lbs.
Maize	4,637	224	2,598	89
Amber Cane	4,616	140	3,140	240
Kaffir Corn	4,122	194	3,091	96
Rape	3,136	336	1,814	45
Lucerne	6 317	873	2,845	112
Cow Peas	3,673	403	1,950	45
Soy Beans	5,577	717	2,460	112

Summary.

There are numerous other points bearing upon the experiments of the year which might be touched upon, but the limits of this paper will not allow of this. A review of the results embodied in this paper might, I think, suggest the following conclusions :—

1. That there is a very wide range of summer forage crops adapted to that portion of Victoria in which the experiments were conducted, and the possible arrangements from such a list of crops of a rotation capable of providing a wealth of succulent fodder from the first failure of the spring pastures till the utilization of the early sown winter crops in the following year.

2. That maize, although to a certain extent justifying the position of favour, which it at present holds with the dairyman, owing to its great earliness, may still be followed with advantage by other succulent

SOY BEAN PLANT.

SOY BEAN PLANT WITH LEAVES STRIPPED.

crops giving heavier yields of equal nutritive value and, in cases, of greater palatability.

3. That the introduction of improved varieties of maize, from the point of view of a fodder plant, should receive consideration. The requirements in the direction of improvement appear to be a plant throwing up a greater number of stalks branching from the base, of greater succulency, and a larger proportion of leaf.

4. That certain of the sorghums, notably amber cane and Planters' friend, give promise of proving valuable additions to the summer crops of the South. The less apparent loss in the feeding of these crops, compared with maize and their greater leafiness and palatability, give, in addition to their large powers of yield, a set of qualities sufficient to place them as a food supply for later periods in a higher position than even maize.

5. That the two millets tried, notably the Japanese, have nearly throughout proved a marked success, pleased the eye of the farmer and given heavy yields. The results obtained indicate the advisability of a wide system of future experiment with the many varieties of this class of crop. The great earliness, quick second growth, and, under favorable conditions, heavy yields of the Japanese variety especially mark the crop out as one which will probably prove of great value.

6. That the very large yields in the case of rape indicate an adaptability of the South of Victoria for this crop, exceeded, perhaps, by no part of the world. Open to objection, probably, as a food for milking cows, it will still serve as a most valuable crop for the dairyman. Its large possibilities in the production of pork and mutton have as yet barely dawned upon the farmer. Of all the crops tried it shows the most marked response to liberal fertilization. It is useless to expect large crops on the poorer soils without such treatment.

7. That the beet as a fodder crop has shown the same wide range of adaptability to the soils of the South as the rape. The special value of this crop will be in its possible utilization at a period when the other crops are done. Giving less yields by probably more than half than the mangel it still seems to be preferred to this crop by a large number of farmers who have grown both. The opinions of nearly every grower in the Maffra district in its favour are the best evidence which can be offered the dairyman. The crop should be grown on every farm of the South.

8. That the marked success of the cow pea in the two instances referred to, and the partial success of the soy bean in one case indicate a possibility of both these crops succeeding in the South, but that experiments for the purpose of both proving the particular varieties suitable and the most appropriate times of sowing are first necessary before recommending the crops generally. As both crops are of special value, owing to their high protein content, experiments in this direction are particularly desirable. In fact, all future forage experiments should

be carried out with special regard to the introduction of annual crops rich in protein. It should be the aim of the dairymen to raise as much as possible of this costly nutriment on his own farm.

9. That the use of artificial fertilizers on soils of poor and medium quality will result in increased yields fully justifying the outlay, and that there is reason to believe that the productive power of large areas, at present considered of little value, may, with such treatment, be raised to a very considerable degree. The result obtained from the use of manures on the various crops of the experimental fields indicate that applications of artificial fertilizers to the natural pastures will prove a highly profitable procedure.

Conclusion.

The facts I have brought under notice will show the main results that have been obtained in the experiments and indicate the lines for future activity. Enough I think has been made out to show that some valuable lessons have been learnt. There is clear evidence that even from the list of crops so far tried, a rotation might be worked out capable of providing an unbroken supply of succulent forage from late spring till the first use of the early sown autumn fodders. There is clear evidence that the farmer need not be tied down to his one crop of maize, but that there is at his choice a wide selection of other crops exceeding even maize in their total yields as well perhaps as in other qualities. The enormous yields of forage procurable in Southern Victoria must force upon all the great possibilities of a more intensive farm practice. These possibilities to my mind appear unlimited. The larger use of manures, a greater variety of crops and the introduction of the soiling system ought to advance the dairy industry by leaps and bounds.

HEADS OF JAPANESE MILLET.

HEADS OF PEARL MILLET.

THE AGRICULTURAL SOCIETY AS AN EDUCATIONAL MEDIUM.

By Hugh Pye.

During the last decade the one prominent sign that marks a well-defined period in the agricultural thought of Australia is the attention that has been given by farmers to the sciences in connection with agriculture. The farmer is being educated every day in all parts of the world, and now it is very rarely that we meet that open antagonism to progressive thought in agricultural methods, even in the great bulk of farm labourers, thanks, in the main, to the steady influence of the State School education imparted to every child of this State.

Long before the governments of the various states took up the question of distributing agricultural literature, the press of the Commonwealth was to the fore in carrying out this good work. To-day the distribution of agricultural knowledge is undertaken by the state governments, and there is no doubt of the good results that accrue to a number of progressive agriculturists who take advantage of the wealth of information placed before them, still, this does not reach the bulk of the rural population, but only the section that knows how to help itself. How to uplift the mental plane of the least progressive agriculturist is the vital point, and this cannot be done till his sympathies are enlisted. At present he is not quite sure of the truth concerning many simple experiences that are met with every day; thus, that the parasitical fungus, rust, is of plant and not of animal origin, that ball smut and loose smut of wheat are different fungi, these and such-like examples point to the fact, that he does not understand the scope and aims of the expert. Simple truths, such as the above, are the alphabet of an intelligent reading of agricultural articles, and thus some of the literature might with advantage dwell more on the education of that section of the farming community which has not enjoyed opportunities of acquiring the knowledge. There is often too much taken for granted, and it is difficult for one who knows the subject well, to conceive the necessity of dwelling on such rudimentary details, but to the agriculturist seeking for light, it makes a vast difference in his appreciation of a lecture or article, and enables him to obtain an intelligent idea of the subject treated.

I believe that a very convincing method of educating the farmer in general to think, and to appreciate the work that the scientist is doing for him, would be to bring the microscope more into use, and show him, where possible, the actual cause of disease in his plants, stock and products. Let a man understand why he applies certain remedies, and he does his work intelligently, otherwise he is groping in the dark. In every agricultural society, there are a few members, who,

with very little instruction, could manage a microscope suitable for the purpose, and especially if sets of properly mounted slides of the objects to be viewed were forwarded from the Agricultural Department, accompanied by a leaflet containing practical and scientific information that could be read and discussed at the meeting. If it could be arranged it would be advantageous to extend this system of instruction, working it somewhat after the style of a circulating library. Thus models, charts or plans, a suitable microscope with slides, also pamphlets and books could be purchased either by public subscription, with or without government assistance, or solely under the auspices of the state. In the latter case a complete system of organisation could be arranged, and an active supervision maintained. The educational set could be arranged by the individual experts in order to suit the various industries; thus, in the fruit-growing districts, specimens of fungoid and insect pests, and leaflets dwelling on their life histories and remedies would form two sets; plans of suitable buildings, descriptions of irrigation methods, the packing and grading of fruit, the planting and pruning of trees, may form others, whilst, as far as could be managed, the other producing industries could be similarly assisted. By placing the models, etc., under the charge of the local state school teacher his pupils may also reap some benefit, and help to extend the interest. The rural state school teacher is usually a keenly interested citzen, and will voluntarily do much towards assisting in matters pertaining to the rural population, and he, should there not be a member in the society who can undertake the work, may attend to the microscope and models. The accompanying leaflets and books would give all the necessary instructions and information, hence it would not necessitate the presence of the expert, though doubtless on occasions his presence would be a great advantage.

It must not be inferred that we need the farmers to become first-class scientists, nor could it be expected, but we hope to impress them with the advantages of being familiar with the elementary principles of some of the sciences, in order that they may be able to adapt themselves to all the varying conditions under which they may be placed, also understand what they read, appreciate the practical experience of others, and apply their knowledge in an intelligent manner. What is really needed is a committee of energetic men and women, whose sympathies are strongly enlisted in the advancement of rural industries. I believe it would be an advantage to have this committee formed in conjunction with the agricultural society, but not necessarily so. If it were, possibly the society's membership list would be increased should the work be carried out successfully, by encouraging the farmers not interested in the society to attend the educational gatherings. Perhaps it could be arranged to charge a nominal subscription for those not members of the society and class them as associates. This may be the means of inducing associates to become full members later on.

By having a committee independent from that which governs the annual show, men and women interested in the educational aspects of

the society, in conjunction with the President and Secretary, could formulate a scheme whereby a live interest in the work could be maintained.

In the rich farming districts, where nature is kind, the agriculturist does not seem to feel the need of entering into the minor rural pursuits, and he has rather royal ideas in regard to his calling, hence his sympathies are not very warm in fostering these. To the agriculturist of the less favoured parts, the minor rural industries are as the salt of his existence, and may, as dairying, become the fundamental source of his prosperity, and that of his country. If it should happen that the educational committee of the farmer's progressive society were independent of the agricultural society, then it would increase the expense, and a share of the government grant should be apportioned to it, but as this would entail more government supervision, and result in a certain loss of cohesion among the members of the two societies, it would be far better to have a united society with one great aim before it—the advancement of the producing interests, individually and collectively.

VARIETY TESTS OF WHEAT.

By D. McAlpine.

Scope of the Work.

These experiments were continued at Port Fairy under the charge of Mr. Wm. Goldie, and although 1902 was not generally regarded as a rusty year on account of the drought, yet on low-lying, damp ground at Port Fairy there was sufficient to discriminate between rust-liable and rust-resisting varieties. In the early part of the growing season, when rust began to attack the crops, it was inclined to be dry, and, therefore, the rust did not make much headway, but later on there was sufficient moisture to encourage the parasite, and the late crops were inclined to be rusty.

As usual, there were a number of single seed plots in which new varieties of crossbreds were tried on a small scale in order to test their general fitness for further cultivation, and big plots, consisting of a few acres each, in which the more promising varieties were tested on a sufficiently large scale to allow of their yielding, milling and rust-resisting properties being practically determined.

Mr. Farrer, with his usual generosity, sent me some of his best crossbreds which he had proved to be of very high excellence in the mill. A few of them were noted as specially adapted for the Mallee, but since experiments there had to be discontinued owing to lack of funds, notwithstanding the very promising practical results obtained in previous years, these varieties were all perforce grown at Port Fairy.

Mr. Farrer, as Wheat Experimentalist of New South Wales, had already expressed his high appreciation of variety tests of wheat being conducted in the Mallee, and in a recent letter to me said.—" It seems to be a pity that you are giving up experimental work in the Mallee. It is one of the places where you ought to continue to do it. Your soils there are doubtless greatly wanting in vegetable matter, and for that reason, I fear, you will never be able to grow any but weak-flour varieties."

As the result of this season's test, the following five crossbreds have been retained for further trial :—

1. 30 (m_3).
2. Nonpareil × Sheltie.
3. Bunyip.
4. Federation.
5. C (F.)

In the big plots several varieties were sown, such as Rerraf, Ranji, and Leak's Rust-resisting, but none of them were reaped for grain, with the exception of Rerraf. This variety has done so well, and is

likely to be such a valuable addition to our profitable wheats, that a somewhat full account is given.

Rerraf.

In 1898 Mr. Farrer sent me, among the wheats which he annually supplied for trial, a small packet of Rerraf. It was derived from a "sport," or natural crossbred he obtained, in 1894, in a drill of Blount's Lambrigg, and is not one of his numerous crossbreds. On account of its origin special attention was given to this "sport." It was divided into two distinct types, one of which produced soft grain, and had characteristics considerably resembling those of Purple Straw. This type was speedily discarded. The members of the second type produced harder grain, which in some at first yielded very strong flour, but as they settled down to their environment the flour-strength of their grain appeared to diminish. Some of the members of this second type appeared to be highly rust-resistant, and others exceedingly rust-liable. Rerraf was selected because it appeared to be a good rust-resister, and because its scanty foliage and earliness appeared to make it likely to suit the Mallee country. After it had been received Rerraf was at first planted in the single seed plots, sufficient seed being thus obtained not only to grow it on a larger scale in 1899, but to send out small parcels for trial in different parts of Victoria. These trials showed it to be a remarkably promising wheat, with clean straw, practically free from rust, only about 2 per cent. of the harmless spring rust occurring on the flag.

In 1900 it was grown in a large plot of 1¼ acres at Port Fairy, and yielded at the rate of 31⅓ bushels per acre. It maintained its character as one of the best rust-resisting varieties. There were patches here and there of poor plants which reduced the yield, but the best ears were selected from the best plants for seed for the next season.

It was also grown at Myrniong, a noted rusty district, along with others, where it showed itself to be the best hay-wheat, and was remarkably free from rust.

In 1901, when the season was very favourable to rust in such districts as Port Fairy, Rerraf again showed itself to be one of the most valuable varieties as regards rust-resistance. In addition to being clean and an excellent hay-wheat, it is early, has stiff straw, holds its grain well, while the yield was at the rate of 40 bushels per acre of fine plump grain. In the Mallee, at Waitchie, near Swan Hill, this wheat gave the best yield of the season, the total rainfall at that place for the year being only 8 inches, and 5·93 inches was all that fell between the dates of sowing and ripening. A Mallee farmer who had been growing it wrote to me in regard to it as follows :—"Very few farmers will get an average yield of 4 bushels per acre, while some are barely getting back the quantity of seed sown. I got 10 bushels per acre of Rerraf off an exceptionally good two-acre piece of fallowed land, and this is the best yield I have yet heard of."

In the past season of 1902, at Port Fairy, it yielded 48 bushels per acre. All the large plots were cut for hay, with the exception of Rerraf, and in view of this circumstance it may be interesting to put on record the conditions under which this yield was obtained. It was sown on 4th July, using about 70 lbs. of seed per acre. The land did not get any manure direct, but the crop followed one of mangels, which had yielded about 80 tons per acre. The mangels had been manured with:—

2 cwt. Florida superphosphate.
1½ cwt. nitrate of soda.
1 cwt. salt.

The ground, when ploughed, was turned to a depth of 5 inches, and the seed sown broadcast and harrowed in. About the 20th December it was dead ripe, and threshed easily with the steam thresher. The field notes I made on it were that it had an upright growth, that it stood about 4 feet high, had moderately stiff straw, held its grain well, was early and stooled moderately.

In experiments with rust-resisting wheats conducted by the Department of Agriculture, South Australia, Rerraf was one of those tried. It is noted as generally yielding well, is regarded as a good milling wheat and a proved rust-resister, but is reputed as having the one drawback, that it is exceptionally difficult to thresh. This latter point was specially attended to at Port Fairy, and no difficulty was experienced with the wheat grown there. Some of the South Australian growers also regard the straw as too fine for hay, but that is not my experience, and is probably only a matter of individual opinion.

The Milling Quality of Rerraf.

With regard to its milling quality, or rather the quality of the flour it yields, Mr. Farrer stated that, in the only trial which has been made of it, its flour-strength was better than that of the Purple Straws in being about a third or a fourth of the way towards the strong flour Fifes in flour-strength.

The Director of Agriculture for New South Wales kindly undertook to have a test of its milling qualities carried out, and accordingly a sample of it, grown during the past season at Port Fairy was forwarded. The following report was furnished by Mr. F. B. Guthrie, F.C.S., Analytical Chemist to the Department:—

Appearance of grain—Slightly translucent, plump, hard, roundish.

Weight in lbs. per bushel—61½.

Ease of milling—Somewhat difficult to mill.

Percentage of mill products—

Flour	71·3
Pollard...	8·9
Bran	19·8

Nature of flour—

Color—low, dark grey.

Strength, *i.e.*, quarts of water absorbed per sack of 200 lbs.—48.

Percentage of dry gluten—11·32.

NOTES.

Bran, fairly clean; flour has a tendency to cling.

Pollard, clean. Break-flour, 24·5 per cent.

Semolina, yellowish and gritty.

This cannot be called a first-class milling wheat. It is somewhat hard to mill owing to the difficulty of cleaning the bran and of obtaining a sufficiently high proportion of flour. The flour is low in color and would not command the highest price on that account. The proportion of gluten is good and the strength fair, but it is less strong than one would expect from this class of grain.

In addition to this, a similar sample was submitted to a leading practical miller for his opinion, and he reported as follows:—

"It weighs 62 lb. to the imperial bushel, is easily milled, gives a fair quantity of good flour, which makes a good springy dough. Compared with a flour made from imported wheat it stood very favourably, absorbing more water in the ratio of 17 to 16. It had gluten 20·8 per cent., while the imported had less than 15. The strength of the 'Rerraf' gluten was 43, compared to 30 in the other. It is excellent."

In conclusion, a description of the ear and the grain may be given. The heads are bald, close, square, smooth, regular, averaging about 4 inches in length, of a pale biscuit colour, blunt at the tip and slightly tapering at the base. The grain is rather small, of medium length, straight, plump, round-bosomed, yellowish, crease about half the depth of the grain, and mealy to horny in cross-section.

Queen's Jubilee.

This wheat was not grown at Port Fairy in 1902, but a bag of it was sent from the Mallee by Mr. Cobham, who grew it there, to his father, to try it on his farm near Reading, England. The results were very satisfactory, as appears from the following account:—"You will be glad to hear your Queen's Jubilee has done well. It has yielded more than 4 quarters (32 bushels) to the acre, and the quality is very good. It weighs 65 lbs. to the bushel, and seems to be all flour and scarcely any skin. It is a pretty wheat to look at, and I am going to sow it again, when perhaps it will do better still. 62 lbs. to the bushel is about the average here, but a good average."

Queen's Jubilee has the drawback of being rather rusty, and on that account, although it is generally a good yielder, farmers are not recommended to grow it alone, to the exclusion of more resistant varieties.

A bag of Outpost was sent at the same time but it does not seem to suit the English climate, for the quality is said to be inferior and only weighs 55 lbs. to the bushel.

THE STORY OF REFRIGERATION.

By R. Crowe.

A Paper read at the Annual Conference of the Australian Butter and Cheese Factories Managers' Association, 1903.

Although the application of refrigeration as a means for preserving perishable produce is of comparatively recent date, ice was in extensive use as a cooling agent very far back in the world's history indeed. The existence of immense areas of ice in the Arctic and Antarctic regions may be said to be co-eval almost with the evolution of matter itself. In more temperate climates ice will form on lakes and rivers in the winter, and very low temperatures with snow and ice exist on the tops of high mountains, even in the tropics, where the air is chill and more rarified than on the plains. The cold air in its descent is heated by the sun, and re-ascends to the peaks—a constant cycle. As air becomes expanded by heat its capacity to contain moisture increases, and in its passage over the earth's surface, especially over lakes and seas, the winds become laden with this moisture, which, when condensed, as you all know, falls to the earth as rain or snow. The great peaks of the world attract the largest volume of this warm, moisture-laden air, and vast quantities of ice are collected, melt, and again accumulate there as the ages roll onwards. It melts in the summer, or eventually becomes so heavy as to slip down the hillside as glaciers. In nature heat means life; cold means death. Nature's great refrigerating system must, therefore, be recognised as the most powerful factor in keeping the peoples of the earth invigorated, for by it, too, is the vegetable kingdom perpetuated. In several parts of the world what might be termed natural artificial refrigerators, the refrigerating effect of rapid evaporation, are in existence. In many of the caves in Sicily, where the formation is largely volcanic, the air in its passage through the porous rock and earth is divided into multitudinous currents, and ice freely forms in warm weather and melts in the cooler seasons of the year. *Ice and Refrigeration*, of July, 1901, describes a natural ice machine existing near Annapolis, U.S.A., where the snow accumulates in a gorge to a depth of from 10 to 15 feet in the winter, the loose stone of the hills around, allowing sufficient evaporation to keep the snow till the summer's sun melts the surface. The water thus slowly formed is transformed into ice as soon as it reaches the currents of cold, dry air from the bottom of the crevice. Somewhat similar phenomona have also been discovered in Custer County, Montana, and York, Kent. The ancients were undoubtedly acquainted with some of the elementary principles of refrigeration, for, copying nature in their methods, they found that drinks placed in porous earthen pots kept cooler than they would in non-porous vessels. The ingenious Egyptian and the learned East Indian from the earliest

historic times made ice by placing water in shallow earthen vessels, covered with stalks of corn or sugarcane, and allowed nature to do the rest. This system of refrigeration by means of the free and rapid evaporation of water through porous vessels appears to have been in use also in the palmy days of ancient Greece, and evidence exists too of its practice in the middle of the third century, B.C. Refrigeration seems to have been virtually ignored in very hot countries up till recently, although in Greece and Rome, in Cæsar's time, it was so commonly adopted, that the serving of uncooled drink to a guest was deemed the height of inhospitality. Apparently, the practice of cooling liquors at the tables of the great was not in vogue in France till the end of the sixteenth century, but by the end of the seventeenth the luxury must have been very common, as the government assumed control of the trade in ice and snow, and farmed the business out, to raise funds for the support of an extravagant court. As an article of commerce, however, natural ice did not assume large dimensions till the nineteenth century, America and Norway being the chief sources of supply. So extensive did the trade become in 1886 that a new impetus was given to shipbuilding, and the demand for material in which to pack the ice became so great, that old neglected sawmills were sought out, and high prices given for previous accumulations of sawdust, the total year's supply harvested at that period exceeding 20 million tons. The United States now easily leads the rest of the world in the use of natural ice. It was not until 1845 that ice began to be sold in London for general household purposes, although considerable quantities were imported from Norway and America prior to 1825, chiefly for the use of London confectioners.

Artificial Refrigeration.

The refrigerating properties of saltpetre were first practically employed by the Italians, and about the year 1550 all the water, as well as the wine, drunk at the tables of the Roman aristocracy, was cooled by placing the liquor in a bottle or globular vessel immersed in another wider one filled with cold water, saltpetre was then thrown gradually into the water in the outer vessel, and dissolved. As far back as 1507 various cooling mediums were used, the most common being a mixture of salt and ice, which was employed by Fahrenheit, in 1762, when he placed the freezing point of water at 32 degrees. About the middle of the eighteenth century, scientists were experimenting with a view to the production of ice by mechanical means, and, in 1755, Doctor William Cullen invented a machine which reduced the atmospheric pressure with an air pump, and increased the evaporation of water to such an extent as to produce intense refrigeration and ice. This was the pioneer ice machine of any description. Some years later it was discovered that sulphuric acid had a great affinity for water, and ice was made through this agency. Early in the nineteenth century, Michael Faraday, assisted by Humphrey Davey, demonstrated that gases could be liquified by mechanical compressors, with continuous cooling apparatus to carry away the

heat developed by force, although it is said that the first hint regarding the liquefaction of air came from Jacob Perkins, an American engineer, to whom must, be accorded the credit of inventing the first really practical ice machine, which was patented in 1834, ether being the refrigerant employed. The evaporator containing the ether was enclosed in a system of pipes through which brine was circulated, the temperature of which was reduced to 5 degrees Fahr. To make ice, vessels holding water were placed in the brine, which was kept circulating in the pipes, establishing the cycle upon which the principle of most modern refrigerating machines is founded. This patent was substantially improved on by Dr. James Harrison, of Geelong, in 1856. Just about this period many patents for ice-making machines were registered in the United States, but only those of Professor Twining and Dr. John Corry were of any value. In addition to making ice, the latter was designed for use in the cooling of sick rooms as an alleviating agent in the treatment of fevers, etc. Whilst Dr. Corry was devoting his whole energies to the problem, the practical solution of which he probably even then recognised as a benefit to mankind, Dr. Harrison was hard at work improving Perkins' apparatus at Geelong. After many experiments and delays Dr. Harrison ordered two machines in August, 1850, from the engineering firm of P. N. Russell & Co., Sydney, and in the following year the brewing firm of Glasgow and Thunder of Bendigo installed a refrigerator of the Harrison type. This was the world's pioneer of such machines, as well as the first mechanical refrigerator used in Victoria. All previous efforts had been concentrated on the making of ice, but up to this time none of the discoveries appear to have been applied to commercial manufactures. Harrison then commenced to experiment in the refrigeration of meats, and he forwarded a large quantity on the sailing vessel *Norfold* from Melbourne to London. Naturally he did not think of putting a machine on board the ship for use on the voyage. A quantity of artificially made ice was carried to keep the meat safely, but the supply gave out before the journey was completed, and the cargo went bad and had to be thrown overboard. The value of his labours is now generally recognised. Although his discovery paved the way for the now large export trade in perishable products, like many other enthusiastic inventors, his reward was financial ruin, and he died in his cottage at Point Henry, near Geelong, on September 3rd, 1893, nearly ten years ago. The use of compressed air, anhydrous sulphurous oxide, anhydrous ammonia and carbonic anhydride, on account of their great suitability have since been adopted as refrigerating agents, and are applied by mechanical means similar to the sulphuric ether machine designed by Harrison. This alteration was rendered the more necessary on account of the dangerous nature of ether. Mr. Quarrill of Geelong recently informed me that an explosion took place once when the doctor was working his machine, and instead of being alarmed, he was found covered with dust and bleeding, looking for the cause of the explosion. Amongst the many inventors who have since contributed towards the perfection of refrigerating apparatus, the names of Carre, Linde, Pictet, Selfe, Bell-Coleman, Haslam,

McDonald and Humble should not be forgotten. As the result of their labours, we have now a choice between any of the four refrigerating agents just mentioned, and there are absorption machines, such as the Taylor type, single-acting mechanical compressors, such as the Hercules, double-acting compressors, some of Linde's serve as an example, and compound compressors, such as Humble and Sons.

The service may be either direct expansion, brine circulation, or the Linde dry air system or its modifications. I will be very pleased to show the members attending the conference, the machinery of the Government Cool Stores at any time that may be convenient, when a better opportunity will be afforded of going into details, and a practical demonstration will do more good than merely quoting particulars in the abstract.

Practical Application of Refrigeration.

Mr. Thomas Sutcliffe Mort, one of the founders of the firm of Goldsbrough, Mort and Co., and founder of the Fresh Food and Ice Company of Sydney, prophesied in his opening speech at the meeting of the latter Company, in 1861, that the ultimate outcome of the frozen meat trade would be that "the half starved nations of the earth shall now be fed." He spent fully a quarter of a million pounds sterling in trying to develop the shipment of meat to England, and shortly before his death expended thousands of pounds in fitting up the P. and O. Steamer *Northam*. Nitrate of ammonia was the agent employed, but although every care was taken and no expense spared in fitting up the vessel, the plant failed before the ship left the wharf and was discharged. Mr. Mort died soon afterwards without seeing the scheme he had cherished for years actually realized. The practical solution of the problem of exporting frozen meat is due to Mr. Coleman, who applied the direct method of cooling air. The steamship *Strathleven* was fitted up with a Bell-Coleman air compressing machine, in 1879, and 400 carcases of mutton were shipped from Sydney and Melbourne in December. Considerable gratification and excitment were occasioned when after a 42 days voyage, the cargo was safely landed in England in good condition. This was the beginning of the export trade in perishable and frozen products, a trade that has already done much for Australia.

But it is in refrigeration as connected with the dairying industry, that we are naturally most concerned. Butter was exported from Victoria successfully in the refrigerating chambers in 1888. At first it was thought that only chilling was necessary, and it was asserted for years that if butter were frozen the fat globules would burst and its quality thus be spoilt. The exact temperature requisite was long a debatable matter and even now there are some who maintain that butter should not be frozen. You will remember that the Department of Agriculture some 18 months back endeavoured to bring about a reduction in the shipping temperature of butter, but owing to the opposition of three individual firms the attempt was frustrated. There

was at that period ample evidence for the justification of such a step. It was generally known that butter carried or stored at low temperatures turned out better than that shipped or stored at a comparatively high temperature. I trust that the dissentients have since been converted, but if they have not, then it is to be hoped that carefully conducted tests made in the meantime will assist in that direction.

On the 9th of March last I wrote to ten butter factory managers asking for three boxes of butter from the same churning, for the purpose of demonstrating the value of storing at a low temperature. On the 26th two lots were received. Two other lots reached the cool stores on the 1st of April, also one on the 17th, and another on the 26th, making a total of six lots, or eighteen boxes, altogether. One sample from each parcel was stored at 20 degrees Fahr., one at 30 and another at 40 degrees. The first lot scored 96 points when received, and on being examined 53 days afterwards, the box stored at 20 degrees scored 95 points, the one at 30 degrees 95, and the one at 40 degrees 93. No. 2 also scored 96 points on arrival, and 53 days afterwards the box at 20 degrees scored 95·5 points, the one at 30 degrees only 94, and the one at 40 degrees as low as 91 points. No. 3 scored 92 points on receipt, and 47 days subsequently the box at 20 degrees scored 90 points, that at 30 degrees only 88, and the one at 40 degrees no more than 85 points. No. 4 scored 97·5 points on arrival, and 47 days afterwards the box at 20 degrees scored 95·5 points, as against 96 for the one at 30 degrees, and 94 for that at 40 degrees. No. 5 scored 96 points on receipt, and 31 days afterwards the box kept at 20 degrees scored 95, the one at 30 degrees 94·5, and that at 40 degrees 90 points. No. 6 scored 97·5 on arrival, and 20 days afterwards the box kept at 20 degrees scored 97, that at 30 degrees 96·5, and the one at 40 degrees 96 points. In the case of No. 4, the box stored at 30 degrees scored half a point more than at 20 degrees. This, however, was the exception. It is also seen that No. 3 showed greater deterioration between 20 and 30, whilst the general rule was that the greatest falling off was between 30 and 40. The average points scored by all the butters on receipt was 95·83, the section stored at 20 degrees scored 94·5, that kept at 30 degrees scored 93·5, and those at 40 degrees scored 91·5 points at the end of the storage period. In other words, less deterioration took place in the case of the butters stored at 20 degrees than in that stored at 30 degrees or 40 degrees. The lot kept at the highest temperature turned out the worst in quality. In money, a difference of £2 per ton exists in favor of butter kept at 30 degrees as compared with 40 degrees, and £3 per ton on the side of that stored at 20 degrees as compared with 40 degrees. The advantage with an export of 10,000 tons a year is obvious, and our dairymen should be assisted to get all that is possible for their product. The Department of Agriculture offers to perform the additional work necessary free of charge, and only asks the shippers to allow their butter to be detained here two days longer than hitherto, to reduce the temperature to the required degree.

Ripening Cheese in Cold Storage.

Owing to the continued satisfactory reports from Canada and the United States last year, regarding the maturing of cheese at low temperatures, the Agricultural Department here took steps to demonstrate its value to the dairymen of Victoria. Quantities of cheese have been received and put into cold store at various times since early in December last. In each case duplicates from the same vat were kept in the factory to be ripened in the ordinary way at about 68 degrees Fahr. On account of not being able to afford a special chamber for cheese, a thorough or systematic plan was out of the question. The cheeses were placed on arrival in an egg chamber at 31 degrees Fahr., this being the highest temperature available. Since then, however, two air-locks have been utilized—one at 38 degrees and the other at 50 degrees Fahr. The humidity of each place was different—that of the egg chamber being kept at 75 per cent.; in one of the air-locks it was 60 per cent., and in the other 95 per cent.

These experiments are not all completed, and the railway strike prevented the arrivals of duplicates from the country to enable comparisons of quality to be made. However, I have sufficient evidence to permit me to safely announce that the system will prove a great boon to producers. As well as getting an improved quality and better prices, they will be able to market more cheese from every gallon of milk. The aggregate gain will be sufficient to leave a good profit after providing for the increased cost of treatment.

The loss of weight in cheese in the curing period is chiefly due to the evaporation of moisture, and in hot weather to leakage of fat in addition. The extent and rapidity of loss depends on the per cent. of moisture originally in the cheese, the texture, the shape and size, the temperature, and the proportion of moisture in the air. The average loss of all the cheeses kept in cold store for three months equalled 6·30 per cent. against 10·43 per cent. in the case of the duplicates at the factories under ordinary conditions. The small cheeses averaged 9·0 per cent. and 10·83, whilst the large resulted in 5·97 per cent. and 10·37 per cent. respectively. The only comparison of quality made so far turned out decidedly in favour of the cheese ripened in cold store. As well as being milder and cleaner in flavour, it proved to be firmer in body, and suitable for a better class of trade. Messrs. Wood, Dunn and Co., agents for the factory, report on the quality as follows: —"On careful examination of every cheese we are certainly of the opinion those matured under freezing conditions are fully ½d. to 1d. lb. better in quality than those kept under ordinary circumstances."

About 5,000,000 lbs. weight of cheese is made in Victoria yearly, at least 3,000,000 lbs. of which is manufactured from November to March that might be advantageously ripened in cold store. The saving in weight alone at 4 per cent. would total 120,000 lbs., equal to the whole year's output of a tidy little factory. An improvement in quality to the extent of only ¼d. per lb. would be worth £3,125, and this added to the increased output at 6d. per lb., £3,000, makes a

a total of £6,125, one half of this amount would pay for the greater cost of storing at a low temperature, and the balance might be pocketed by the dairymen.

Cold Storage of Eggs.

As it seemed unlikely at the beginning of last spring that there would be sufficient produce offering to utilize all the space at the Government Cool Stores, the Department of Agriculture issued a circular to all butter factory companies, as follows:—

"Owing to the success met with for the past number of years in keeping eggs by means of cold storage from the season of plenty during the months of September, October and November when the local market is glutted, to the season of scarcity in April, May and June, when eggs are selling at high prices, the Department has decided to offer producers greater facilities for next season. One of the conditions for successful results in this business is, that the eggs should be clean and fresh at the time of placing in cold store. In order to surmount the difficulties in the way of securing that end, the Department recommends that collecting depots be established in connection with all butter factories and creameries in the country. The suppliers could bring their surplus eggs to the butter factories, creameries and cheese factories, when delivering their milk and cream. The factories could appoint a receiver, who would for the three months before-mentioned check the number of, and pack for consignment, the eggs received each day. A pass-book should be issued to each, such as is used in connection with milk and cream, showing a column for eggs received conditionally each day, and a column for rejected eggs, that is, those which, when packing, are found to be bad, dirty, small or broken. In order to save disputes as to ownership of unsuitable or rejected eggs, it is recommended that each supplier should have a small rubber or cork stamp with a separate number for each—these stamps would not cost more than 6d. to 9d. apiece. With most butter factory and creamery buildings, a spare room, back verandah or shed exists, that might be devoted to this branch of industry."

"In the case of companies whose articles of association prevent them from embarking in the business, the individuals, who compose the company, might form an association to carry on the trade and lease a portion of land or premises from the former for the purpose, until the constitution of the company could be altered in order to permit of the carrying on of an egg storage business in the interests of their suppliers. Suitable cases and fillers can be secured at a cost not exceeding 1d. per dozen. A sample box will be supplied by the Department on application. The charge for storage is 3d. per box of 2 cubic feet for the first week, and 1½d. per week or portion of a week following."

Although no companies took the matter in hand, 1,200,000 eggs were secured for storage, which cost 3d. per dozen in advance

of the rates three years before—that is, prior to the adoption by the Department of this class of egg business. Of course, all eggs marketed in the flush of the season brought equally advanced prices. It is estimated that 140,000,000 eggs are produced in Victoria yearly, over 100,000,000 of these are laid in the spring-time, at least half of which are disposed of to non-producers, therefore, in consequence of refrigeration in the egg trade, producers are now pocketing over £52,000 a year more than formerly. This amount is not as yet added wealth to the country. So far the result has been to make rural pursuits more profitable and attractive. Rapid development must follow this incentive to production, and later on the whole community will benefit.

General.

Sufficient experience has been gained in connection with the export trade in frozen pork and veal to warrant giving a decided assurance to producers that they need not, for very many years to come, be afraid of overdoing this business. With the adoption of refrigeration the surplus can be safely sent to any market in the world for disposal.

By the aid of artificial refrigeration the whole community of Victoria has benefited to the extent of some millions of pounds sterling during the last fourteen years. Through its agency an export trade in mutton and lamb, beef, dairy produce of all kinds, poultry, rabbits and hares and fruits has been rendered possible. Storage of those goods from the season of plenty to that of scarcity is also taken advantage of by the process. But with the extended application of this latter phase of refrigeration in the northern hemisphere, the Victorian dairy farmer will directly be brought face to face with a serious problem, and one which is soon bound to act detrimentally to his interests. In the meantime, new means of assisting him are coming into operation every year, and it is to be hoped that Victorians will continue victorious in the race.

NOTES ON CHEDDAR CHEESE-MAKING.

By R. T. Archer.

So much has been written and said about cheese-making that it may be asked, "What more of interest is there to say"? However, there are many points about which less experienced makers inquire for information. Probably the principal amongst these is the best method of treating over-ripe or "fast" milk as it is termed by cheese-makers. But it should be remembered, that no matter what we read or are told it is not wise to make any radical changes in our method of working, till we prove that it suits our conditions, and results in an improved article.

The Treatment of "Fast" Milk.

On the treatment of "fast" milk we may read many opinions, but they do not all agree. Most of them say increase the rennet a little, and that may be a safe plan.

Some say set at a higher temperature, while others advise a lower. A higher temperature will encourage the growth of bacteria, and consequently the more rapid development of acid, which we want to retard as much as possible until the curd is cooked, which means, also, the whey extracted and curd firm. A high temperature, however, increases the action of the rennet so that the milk thickens more quickly, and we thereby secure a quicker start, and so have a chance of getting ahead of the acid. Setting at a lower temperature will have the opposite effect, but, as we would not in any case vary the temperature more than two or three degrees either way, there appears to be no need to alter the regular setting temperature of 86 degrees Fahr., especially when a man of the ability and experience of Professor Robertson, the Canadian expert, recommends a higher temperature, while Wing, the well-known American expert advises a lower.

How are we to tell if we have a "fast" milk? The appearance and the smell may be enough for an experienced maker, but the acidity test is a safe guide for anyone.

As soon as the milk is in the vat ascertain the acidity, and in general if we find ·24 or ·25 per cent. we may depend on it being fairly quick, although, in some districts, milk of this acidity is right for setting, and a quick milk would be ·28 or ·29 per cent. acidity. This, however, is soon found out if the milk is tested, and acidity noted for a few days. Assuming we have a "fast" milk, the best course is not to heat up till it is all in the vat, then have everything ready, add the colour, heat it up as quickly as possible, set with a little extra rennet, and stir for three minutes instead of the usual five minutes, since in extreme cases it may be thick before we have done stirring.

One case of this sort came under my notice where the whole vat full of milk was thrown out, as it was thought a cheese could not be made from it. There was no need for this however. I had a similar

experience, and made a very fair cheese—a long way ahead of much that finds its way to market.

Having finished stirring, watch it closely for thickening. The aim now is to run everything through as quickly as possible to try and get ahead of the acid.

Now suppose the milk thickens in eight minutes, instead of leaving it for twenty minutes before cutting, we may do it two or three minutes sooner, and as rapidly as we can, giving an extra cut with one knife, by which means the curd will be in rather smaller particles, and the whey will come out a little more freely. Clean off the sides of the vat, and get the steam on as quickly as possible, and cook in about twenty-five minutes. It may be cooked to 102 degrees, but it is not advisable to go higher or the curd may have a burnt taste. A good rule to adopt for the time to take in cooking is :—

Thick in less than	$8\frac{1}{2}$	minutes,	cook in	25	minutes.
,,	$8\frac{1}{2}$ to $9\frac{1}{2}$	,,	,,	30	,,
,,	$9\frac{1}{2}$ to 11	,,	,,	35	,,
,,	11 or over	,,	,,	40	,,

Having run the temperature up, keep stirring. This will assist to remove the whey. Run off part of the whey if the tap is at all small. For the rapid removal of the whey a syphon is a great help. As soon as there is $\frac{1}{8}$-inch acid get the whey off as quickly as possible, and if the curd has not shrunk sufficiently, or is not firm enough, stir it a bit on the cooler before allowing it to mat. Leave it about five minutes to mat before cutting, and then turn about every five minutes so that whey does not collect on the top of the curd. As soon as the hot iron shows $\frac{1}{2}$-inch acid it is ready to mill. If salt is added at the same time as it passes through the mill it will not mat or lump so quickly, and the salt will be more evenly distributed. It is often said that salt checks the development of acid, but the correctness of this view is very doubtful, for if the whey dripping from the piled curd test ·4 per cent. acidity, it will be found the drippings from the press an hour or so afterwards will test ·8 per cent. or more. This will be invariably so, no matter when the salt is added. The acid develops more quickly when the curd is milled and exposed to the air than at any other stage, and the best way to check it is to quickly reduce the temperature, and get it into the hoops so that the air may be pressed out. After milling stir all the time till the curd is cooled down to 80 degrees, at which temperature hoop it. Stirring at this stage has a very beneficial effect on the curd as the air helps to sweeten it very much, taking it for granted that the air is pure, as it always should be, in a cheese factory. If the curd does not cool down quickly enough throw it back into the vat and run cold water underneath, which will cool it in a few minutes, and very often save hours in hot weather. It is often recommended that after milling the curd should have warm water (about 102 degrees) thrown over it to wash out the excess, but I have never tried that myself. Dr. Russel, of the Wisconsin College, has proved that it always causes a bad cheese, as the quantity of the lime salts, which are

essential to the proper maturing of the cheese, are washed out, and the only way to prevent it being a bad cheese, is by replacing the lime salts in the curd. Those who recommend washing the curd also admit that a lot of fat is washed out, and the cheese thereby reduced in quality. Try to get the cheese into press so that the liquid from press does not show more than 1·0 per cent. acidity.

If the cheese is soft when taken from the press, it is well to turn twice daily for a few days to prevent it going out of shape. It is better matured at a low temperature where that can be arranged. It is an old and true saying that a "fast" milk produces a quick maturing cheese, so that it should be got away earlier. It would take too long to discuss all the causes of "fast" and tainted milk here, but there is one point I would like to direct attention to, as it may open up a field for criticism and discussion.

Floating Curd.

A few weeks ago one of our most experienced cheese-makers told me he had floating curd four days in succession, and that he proved it to be caused through feeding green maize to the cattle, as he isolated the milk from a herd where they had just commenced to feed green maize and it produced floating curd. The fifth day the curd was normal and still they were fed on green maize. This makes me think that it was not the maize itself that was directly reponsible, but careless, dirty milking, as the sudden change from dry summer grass to succulent maize would have a purgative effect on the cows, and they would get their tails and flanks dirty, and the dung would find its way into the milk.

We know that floating curd is the result of the excessive production of gas in the curd by a particular group of bacilli, whose habitat is the intestines of animals, and it is more likely that the germs gain access to the milk direct from the dung, than that the gas goes directly from the food in the stomach to the milk, although we know there is direct connection between the food and the milk. Doctors have been known before to-day to physic an infant through the mother, which shows that what is eaten, to some extent influences the milk. There is a large field here for investigation.

In an article in the *Leader* a few weeks ago was given an account of some experiments conducted on behalf of the Bath and Southern Counties Agricultural Society, from which conclusions were drawn that gassy curds were caused by germs which did not get into the milk from outside, but directly from the milk ducts in the udder. In Bulletin No. 158 of the Cornell University Agricultural Experiment Station are recorded some interesting results. The inquiry was concerning the source of gas and taint producing bacteria in cheese curd, and several new facts were brought out concerning the bacteria in fresh milk. The research demonstrates that bacteria do exist sometimes in the milk ducts of the udder itself as well as in the teats, it also shows that several species of bacteria, when once introduced into

the udder, are able to remain there for a considerable length of time, thus becoming a constant source of contamination.

Lloyd's investigations in this direction interest us particularly. In his report of nine years work undertaken at the instance of the Bath and West of England Agricultural Society in conjunction with the Board of Agriculture, he concludes that gassy and pin holey curds are caused by the colon baccilli. He set to work to ascertain why certain farms and certain paddocks had the reputation of producing milk that could not be made into good cheese, and in many instances proved that the reason was that the milking cows used to drink in dams where they had to walk right into them and the approaches to which were very muddy. The cows' droppings got mixed with the mud, and on to the udders and teats and then dried on, afterwards to be rubbed and shaken off into the milk in the bucket and so produced tainted curds, and when these water holes were fenced off and the water for them to drink was pumped into troughs, the trouble invariably ceased. Another trouble that had to be investigated was that in connection with cows grazing on what were known as scouring lands, that is, lands which, on the soil being analysed were found to contain a high per centage of sulphate of magnesia or Epsom salts, an excessive proportion of which was taken up by the grass which caused the cattle to scour. The milk from these cows would produce tainted curd, unless very great care was taken. Lloyd said:—"Investigations soon proved that during the making of a cheese there were other than chemical agents at work, namely, bacteria, whose influence for good or bad might be quite as powerful as, if not more powerful, than the skill of the maker." Some of these bacteria, which played an injurious part in the manufacture of cheese, were gradually discovered and one or two were traced to their source. It was ascertained that trouble invariably resulted from contamination of the milk with dirt prior to its reaching the dairy and that inferior cheeses were frequently due, not to any want of skill on the part of the cheese-maker, but to want of cleanliness on the part of the milkers. Dirty hands to milk with, and dirty cows to milk, probably caused more inferior cheese than all other causes put together. When the cows were fed on these scouring lands, it almost invariably resulted in tainted curds. When they were given a change of food, when they were first given cake, it was productive of taint in the curd. As is well known a change of diet is productive of a certain amount of scouring, though it may last only a day or two. It was universally stated that it was impossible to make good cheese off the scouring land.

We learn from these facts that anything which causes cows to scour will spoil or deteriorate the cheese. It will introduce faecal organisms into the milk, cause a faecal smell in the curd and only the very greatest care will enable the cheese-maker to produce good cheese under such circumstances. The only remedy that can be suggested at present is scrupulous cleanliness, which though necessary at all times is indispensable when the cows are relaxed, be the cause what it may.

MILK FLOUR OR PLASMON.

Various Methods of Manufacture.

For a long time past chemists have sought for a method of extracting the water and fat from milk so as to obtain the nitrogenous or albumenoid constituents in a dry and concentrated form, capable of retaining indefinitely the full nutrient value of fresh skim milk. Success has at last been obtained, and no less than three separate processes for this purpose have recently been brought forward.

Plasmon.

The trade name of Plasmon has been given to the first of these so-called milk flours. In the process of manufacture after the removal of the cream, the separated milk is treated so as to coagulate the protein or albumen, and the coagulated mass is then kneaded and dried at a temperature of 70 degrees C., under an atmosphere of carbonic acid gas. When all the moisture is extracted the dried mass is ground into a powder completely soluble in hot water.

This process though rapid is unfortunately expensive and the special machinery required can only be obtained in Germany, where the substance was first prepared by the well-known chemist, Siebold.

Milk Flour.

In Sweden, desiccated milk has been put upon the market under the name of Milk Flour. The skimmed milk has been reduced to the form of powder by Dr. Ekenberg of Gothenburg, and the apparatus by which this result is brought about is known as an exsiccator. At a meeting of the Academy of Agriculture, Dr. Ekenberg exhibited samples of the desiccated milk which elicited favourable opinions. The product possesses all the qualities of milk in a concentrated form, except that the moisture is absent, and it will not turn sour nor ferment. It is completely soluble in hot water and can readily be transported in tins or bags. The cost of production is stated to be about ½d. per gallon of milk treated, or approximately ½d. per oz. for the Milk Flour, and the price of a large evaporating machine is about £250

Nutrium.

According to the *Scientific American*, Dr. Joseph H. Campbell, of Pennsylvania, has likewise succeeded in giving us milk in the form of powder, and to this powdered milk the name of Nutrium has been given. The method of preparation consists in driving off the water by means of blasts of dry sterilized air, the milk being kept in motion at first merely by the force of the air currents, but when it becomes somewhat thickened it is transferred to revolving drums and exposed to blasts of the sterilized air until perfectly dry. It is afterwards ground to powder and packed for despatch.

Uses of Milk Flour.

From the highly concentrated nature of this product it is evident that it will prove of value not so much as a food by itself but rather as an addition to those foods in which protein is deficient. For naval and military forces it will be invaluable. Its extended use in many trades would appear to be only a matter of time, and for invalids and children it is already daily prescribed by physicians. The numerous uses to which this new product has been put are not surprising, when it is considered that a recent Committee of Investigation reported that one ounce of the powder is equal, in nourishing and sustaining properties, to 3¼ lbs. of the finest beef, or about 10 to 12 lbs. of fresh milk.

It is easily seen that the profitable utilisation of the enormous quantities of skimmed milk, that annually goes to waste the world over, will have a most important influence upon the farming industry. The greatest possibilities, from the dairyman's point of view, would seem to lie in the reduction of the cost of production so that it may be possible to utilise milk flour as a food for cattle. As Dr. Howell points out in this issue, in his article on "Co-operative Forage Experiments," it is an easy matter to raise large crops of rape, maize, sorghum, or pumpkins, containing but little protein, but quite a different and much more expensive process to produce forage rich in protein. Something little short of a revolution in farming practice would ensue, should it become possible to furnish our dairy herds with the necessary protein by means of small amounts of milk flour, with a high protein content, added to the cheaply-raised, bulky and succulent fodders containing carbo-hydrates almost exclusively. Doubtless the day is yet far distant when we will regard the cow as so much of a machine that she will be furnished to-day with the protein in the form of milk flour, which she gave us yesterday along with the butter fat as fresh milk. The whole question, of course, is merely one of pounds, shillings and pence. Will it be cheaper to give milk flour to cows or to feed pigs on skim milk, and buy or grow foods rich in protein? The economical production of protein is one of the greatest agricultural problems of the day, so that the possibilities in the use of this new product are worthy of the closest attention.

THE SOUTH AFRICAN BUTTER TRADE.

By J. Kirk Hunter.

(Continued from page 30.)

The Utility of the Government Brand.

One feature that has materially assisted to popularise Victorian butter in the South African market has been the knowledge that all exports were inspected by the Government experts prior to shipment. The understanding of this approval for export takes a wider scope than is actually the case, because it is believed that quality as well as condition is included, and importers are somewhat puzzled to know why different brands of varying quality all bear the same Government stamp of approval. An explanation that the certificate only applies to soundness greatly discounts its value. In my opinion the Government inspection that is given should not only serve as a guarantee of soundness, and so encourage the importer in South Africa to trade with us, but it should be of such a nature, as to foster the exportation of the higher grades. These objects can be gained only by affording the protection of a well-defined Government brand and certificate of approval that will cover quality as well as soundness.

As matters stand at present, the same brand "approved for export" instead of being a help and encouragement to the exportation of the best qualities, which alone can permanently secure the trade of this country, in reality has the opposite tendency, because the lowest quality exported, provided it is sound at date of shipment, commands the same certificate and stamp of approval as the best.

I consider, therefore, that immediate steps should be taken to establish uniformity of quality and description of the various grades of butter, either by name, class, letter or number, and that all Government inspection should cover both soundness and quality, and the certificate issued, and the boxes shipped, be stamped with the distinguishing brand of the grade to which they properly belong.

Such measures could not fail to act beneficially on the trade from both the shippers' and the importers' points of view. To the latter it would convey a more clearly defined idea of the quality he was purchasing, and reduce the opportunity for complaint on the ground that he expected grade 1 when he had only contracted for grade 2.

A Federal Brand.

In the interests of the future of the trade I consider this question of grading of the highest importance, not only for Victoria but the whole of Australia, and I respectfully suggest that the matter be brought under the notice of the Federal Government so that uniform

grades or standards of quality, and the method and extent of inspection should be established for the Commonwealth. I do not know whether it is owing to the constitutional independence of the various states being imperfectly understood, or whether it is due to the desire to attach to federation, commercial as well as political cohesion, but there is no doubt that the merchants and importers of Africa make no distinction between the different States when discussing the articles they import, and especially if there is the desire to find fault. In my inquiries regarding butter for instance—and this applies to other articles—I have very seldom heard the expression "Victorian" butter or "New South Wales" butter, it is always "Australian" this or that, whatever the article be that is under discussion. The consequence is that I have been severely rated on a number of occasions regarding the inferior quality or ill condition of certain shipments that have never seen Victoria.

The managing partner of one firm became very angry when I mentioned butter, and intimated rather curtly he was not disposed to discuss it. "He had had enough of 'Australian' butter," he had been importing it for years, but had lately been treated so shamefully that he was fully determined never to import another lb. After a time I succeeded in eliciting the information, that the butter about which he was so incensed, came from a neighbouring State, and that he never at any time had imported Victorian butter, but still it came within the scope of his somewhat sweeping condemnation. That, of course, provided me with the opportunity of explaining our dairying system, of commending the high quality of our production, and of soliciting a trial shipment of Victorian, which, as I have to see him again shortly, I expect to secure.

Instances like this, of which I could cite many others, induce me to believe that the grading of all butter for export, and the adoption of uniform methods of inspection throughout the Commonwealth could not fail to be of advantage to all the States.

When a general classification of the standard of quality of Australian products, such as I have referred to, exists in the minds of the importers here, it most adversely affects those who are producing the best article, as it is only when complaint is necessary that the comparison is made, which, as I have shown, is usually of a general character. When nothing is wrong, then the inferior production profits by the reputation of the better.

Tinned Butter.

With reference to butter in tins, I have inquired carefully the opinion of every merchant and retailer I have called upon regarding the weights, and I have only found one prepared to advocate the adoption of nominal weights. The trade generally is emphatically in favour of each tin containing 1 lb. net of butter. The Army authorities and the Repatriation Departments of the Transvaal and Orange

River Colony buy by the lb., so that any shortage in the weight of the tins would require to be made up by the necessary additional number.

There is no legitimate argument to advance in favour of the nominal weights. It is usually an endeavour on the part of someone to obtain an unfair advantage over a competitor by offering what is ostensibly 1 lb., but which in reality is considerably less. The public sooner or later discover they are not receiving what they believe they have paid for, and, of course, discontinue taking the article. Thus does the adoption of the system recoil on the maker.

Our shippers should, in their own interest, resist firmly any overtures from customers to put up their established brands in tins containing less than 1 lb., unless they consent to the actual weight being distinctly indicated on the label. Further, I think this is a matter, seeing that it affects the reputation of trade, that the Department should, if possible, deal with.

Harmer's well-known brand of Danish butter, which has a big sale in Africa, is put up in full 1 lb. tins net weight, and I have had that referred to as showing the determination of that firm to protect the reputation of their brand in every way, as against the readiness of some Australian shippers to adopt a course that cannot but eventually adversely affect them and the trade generally.

Margarine and Butterine.

In a market like this, where butter is generally high in price, it is not surprising that a considerable trade exists in butter substitutes, such as butterine, margarine, etc. I append the statistics of the imports into Cape Colony for 1901, which indicate that it is principally drawn from Holland. Considerable quantities also go to the Transvaal. It is, of course, supposed to be used mostly by bakers, but when I was in Johannesburg, owing to the scarcity and high price of butter, the partner for one large firm of distributors informed me he had no doubt that a good deal of what he was selling found its way to the tables of hotels, restaurants and private houses. It is packed in 7 and 28 lb. circular tins, and is sold wholesale in Capetown at about 1s. per lb., and retailed at 1s. 4d. A locally made margarine is also sold wholesale at from 6d. to 8d.

The following are the imports of margarine for 1901 :—

Where From.	Quantity.	Value.
United Kingdom	96,215 lbs.	£2,121
Natal	1,400 ,,	42
Belgium	47,962 ,,	827
Germany	27,927 ,,	721
Holland	610,910 ,,	10,971
United States	128,608 ,,	2,707
Other Countries	77 ,,	1
Total ..	913,099 lbs.	£17,390

Cheese.

This is a product of Victoria that ought to be exported to Africa much more extensively than it is. The attached statistics of imports show that the trade is one of considerable dimensions, but I have not found anything to indicate that our exporters have made much effort to secure a larger share of it.

I fear the desire and effort to effect big deals in other articles has minimised in their minds the importance of the cheese trade, and yet the opening undoubtedly exists for substantial increase, which of course is only to be effected by the agents of the shippers bringing the article directly under the notice of the buyers. For this purpose they require samples of the various makes and qualities, and judging by the readiness shown by those to whom I have spoken to try Victorian cheese, I have no doubt but that any firm in a position to do this trade well, and setting about it energetically, could soon considerably increase their present export.

You will notice from the accompanying table, that the bulk of the importations are from Holland, which is an easy first, the United Kingdom next, and Victoria, a long way behind, fourth on the list. Canada and New Zealand have both lately been doing more in cheese, and when the statistics for 1902 are available, I expect to see that the imports in this article from both these countries have considerably increased. Of course Dutch cheese always will command a big sale here, but the rapid growth of the population, by people not accustomed to eating a cheese of this description, will mean a much increased consumption of cheese such as Victoria produces, and it only requires effort in the right direction by those in the trade to secure a fair portion of it.

The most approved weights are as follows:—

Loaf size, 10 to 12 lbs. each, packed 4 to 6 in a case.

Medium size, about 40 lbs., packed 2 in a case.

Large, 60 lbs. each, packed 2 in a case.

Imports of Cheese into Cape Colony for 1901.

Where From.	Quantity.	Value.
United Kingdom	361,712 lbs.	£11,763
Natal	11,801 ,,	346
New South Wales	815 ,,	22
New Zealand	7,054 ,,	156
Victoria	43,631 ,,	1,092
Belgium	46,867 ,,	1,203
France	2,576 ,,	218
Germany	36,558 ,,	1,206
Holland	3,004,281 ,,	79,306
Delagoa Bay	300 ,,	13
United States	8,139 ,,	220
Italy	2,884 ,,	88
Other Countries	50 ,,	2
Total ...	3,526,668 lbs.	£95,635

RINGING THE CURRANT VINE.

By Thos. Hardy.

Several years ago, when Mr. C. W. Grasby, of Adelaide, made an extended tour through the currant-growing districts of Greece, he gathered much valuable information regarding the treatment of the vines, which he afterwards brought under the notice of local growers through the medium of the pages of the *Garden and Field.*

One of the most useful hints obtained in this visit related to the practice of "ringing," an operation which consisted in making a simple cut or incision around the base of the fruiting canes, or in removing a narrow ring of bark, during the blossoming period. It was said that the effect of this was to increase the yield of fruit and the size of the berries. Many growers then experimented in this way in South Australia, and met with the most gratifying results, and now a considerable body of information is available from local sources.

How the Ringing is Done.

Special implements are manufactured in Germany for this work, and some of these have been imported recently, and by their use the operation is greatly simplified. The usual practice has been to take out a narrow ring, about an eight of an inch in diameter, at the base of the fruiting canes. Sometimes the main stems are treated in this way, and so far as the first year is concerned, there appears to be little, if any, difference in the results from the various methods in use; but in after years it is found that the removal of a ring of bark causes such stunted growth that this method cannot be recommended. Another and better way is to merely make a single cut round the cane and push the bark aside, which is said, by those who have tried it, to answer just as well. Experiments were tried by myself and others last season, to determine whether a simple incision without removing any of the bark, would prove as effective in increasing the yield as taking out a ring. It seems fairly certain that the effect is practically the same as far as the increase in yield and size of the berries is concerned, but the simple incision has the great advantage of causing very much less injury to the vines, and the cut heals over quickly. Whatever plan is adopted, the incision must be made when the vine is in bloom, and it seems as if the check then given causes the setting to be more satisfactory.

The Effect on the Yield and on the Vine.

In South Australia we have definitely proved that not only the crops, but also the size of the berries from the ringed vines, are largely increased. In some instances half as much again as is usually obtained has been recorded, which must be regarded as extremely satisfactory.

On the other hand, the ripening of the fruit is retarded by about ten days or a fortnight, and the grapes are distinctly less sweet and lighter in colour. The leaves, too, are not of such a dark green, and the growth is considerably less than in untreated vines, though under irrigation the latter is not likely to be viewed as a disadvantage. The currant crop at Maclaren Vale, on vines where no ringing was done, was almost a total failure, though in other districts a normal crop was obtained; no doubt a few days earlier or later in the blossoming would account for the different results, a fierce hot wind during the critical period being the cause of the failure.

The ultimate effect of this ringing on the life and health of the vines is difficult to forecast. It cannot be said at present whether the operation, to be effective, will need to be done every year; probably, however, once in two or three years will answer, since the first result is to check the vine, and the subsequent growth not being so strong there is reason to expect that the following crop would also be affected. Indiscriminate ringing year after year might easily so impair the health of the vine as to cause death in the long run. Where a ring of bark, a quarter of an inch wide, was taken out two years ago, the effect on the vines was most injurious, since it resulted in a stunted growth and a tendency to throw out shoots below the incision. We have still to find out whether the increased yield with the single cut will weaken the vines to any extent, and if so how often it will be safe to do it. To sum up, so far as our present knowlege permits us to hazard an opinion, it would seem that there is reason to expect considerable and continued good effects from the simple incision, but due caution must be observed in this as in all new departures. The weakly vines must not be touched, only those in vigorous growth.

VICTORIAN FRUIT IN LONDON.

By J. M. Sinclair.

The "Arcadia" Shipment.

The first consignment of Victorian fruit for the season, consisting of 2,206 cases of apples and 41 cases of pears, arrived by the *Arcadia*. The fruit was landed in good condition, although some of the apples had the skin slightly shrivelled. Both apples and pears were generally small in size some of them not being fully grown, this being the case especially with the pears, which were of poor quality. The pears were packed in single layers with wood shavings in shallow trays, three of these being cleated together, a system of packing which I have strongly recommended from the first. They were stowed separately from the apples, near the air trunk shoots in the ship's chamber, and were landed in sound condition. Some of the apples were affected with the bitter pit, referred to last year as black spot, which always detracts from their value. If possible, it is not advisable for growers to pack any fruit having this blemish, as buyers on this market do not care about purchasing it, or, if so, at such a price as will result in a loss to the Victorian exporter.

Of the consignment referred to, 1,600 cases were sold at Covent Garden Market, and, considering the medium quality of the fruit, made excellent prices. The prices realised were as follows:—

	s.	d.		s.	d.
Apples.					
Cleopatra	12	0	to	20	0
Jonathan	10	0	,,	20	0
Five Crown	11	0	,,	15	0
Rome Beauty	10	0	,,	12	0
Pears.					
Vicar of Winkfield	10	0	to	15	0

The Vicar of Winkfield pears realised from 10s. to 15s. per case of three trays; had they been of good quality at least double this value would have been obtained for them. The remainder of the apples were sold at the Monument market at from 10s. to 13s. per case, although for a few cases of Ribstons and others in which the fruit was small, and affected with the spot mentioned, as low as 4s. to 6s. had to be accepted. It is to be hoped, however, that the next consignment, per *Omrah*, will prove to be of finer quality. There are still considerable quantities of American apples on the market and satisfactory prices will only be obtained for Australian fruit which is sound, well-graded and of good quality.

The "Omrah" Fruit.

This steamer brought 4,860 cases of Victorian fruit advised by the Department and 12,000 cases of Tasmanian apples. The Victorian

consignment of apples was in good condition. The Vicar of Winkfield and Winter Nelis pears, in large cases, were in good order, but a few cases of another variety were wasty and unsound; a few cases of grapes also were not in good condition. A number of cases of apples, chiefly of the Ribston Pippin variety, were very much affected by the dry brown spot, known in Australia as bitter pit, which I referred to last season as black spot, this seriously depreciates their value, the fruits being otherwise large and well-grown. This dry spot extends from the skin inwards, frequently almost reaching the core. I have been informed that a peculiarity of it is that there may be only slight indications of it on the skin when the fruit is gathered and packed for shipment, but the disease increases and extends afterwards, so that the apple is very badly affected in the course of a few weeks, and so loses in value by the time it is offered for sale on this market. Some of the Ribstons sold this week, if sound and free from this disease, would have realised from 13s. to 16s. per case, but only brought from 6s. to 13s. Fruit buyers here recognise at once apples affected with it, and sales can only be made with difficulty. Growers having their orchards affected with this disease in apples should make special efforts to prevent, if possible, its recurrence next season, otherwise their consignments may result in a loss to them.

Prices realised for the *Omrah* consignment were, on the whole, fairly good, especially for the good dessert apples, such as Cleopatra, Jonathan and Munro's Favorite. The Tasmanian apples, being the first shipment of the season, with some of the fruit not fully grown and developed, realised prices very much under Victorian. These were from 7s. 6d. to 12s., only small lots of choice fruit reaching 15s. per case. Prices per case for Victorian fruit were as follows:—

APPLES.

	s	d		s.	d.
Cleopatra	10	6	to	19	0
Munro's Favorite	10	6	,,	16	0
Jonathan	10	0	,,	15	0
Cox's Orange Pippin	11	0	,,	14	0
Ribston Pippin	6	0	,,	13	0
Alfriston	10	0	,,	13	0
Rymer	9	0	,,	11	0
Stone Pippin..	7	6	,,	10	0
Five Crown	8	9	,,	10	0
Rome Beauty	9	9	,,	11	0

PEARS.

Vicar of Winkfield	10	0	to	13	0
Winter Nelis..		—	,,	19	0

Present indications are, with a considerable quantity of American apples yet on the market, and the knowledge of heavy shipments of Tasmanian during the next ten weeks, that prices cannot rule high, and that any apples shipped, which are not of first quality and condition will realise values which may not prove profitable to the grower.

The pears per *Omrah* were in large cases, some in good condition and others wasty. Vicar of Winkfield, in good condition, sold from 10s. to 13s. per case, and Winter Nelis up to 19s. A few half-cases of grapes in this steamer were not in good condition generally, and were sold for 3s. 6d. per case.

The "India" Consignment.

This steamer carried 4,997 cases of Victorian apples and pears, and about 12,500 cases from Tasmania. The Victorian consignment, inspected during discharge, was in good condition. The pears consisting of 251 cases were stowed in a small separate chamber and carried at a temperature of about 38 degrees, the apples at about 42 degrees. The pears were all packed in the ordinary apple case, but the temperature maintained, which I have in previous reports recommended for this fruit, proves its suitability although this description of package is used. In my last report, I referred to the fact that some of the apples were affected with bitter pit, which materially affected their value when sold. Some of the *India* consignment was affected in the same way, Ribston Pippins particularly. Other apples which seem to be subject to this disease are Bismarcks and Cleopatras, and although otherwise sound and well-grown, the appearance of this on the fruit detracted from its value when sold. Complaints are also made that some growers do not quite fill their cases with fruit, and place rather much paper and wood shavings in as packing, and this is soon recognised by purchasers, who reduce their offers accordingly when buying. The Victorian packing and grading is generally spoken of favourably by those engaged in the trade, so enabling better prices to be realised than for Tasmanian.

At the sales of *India* consignment, consequent on the Easter holidays commencing this week, there was an active demand, and good prices, for all the finest description of dessert apples; but with a large quantity of ordinary class fruit from Tasmania, for apples not of first grade, values realised were only moderate.

The prices realised for Victorian were:—

Apples.

	s.	d.		s.	d.
Cleopatra	10	0	to	15	0
Jonathan	9	9	,,	14	0
Munro's Favorite	10	0	,,	15	0
Rome Beauty	9	9	,,	12	0
Cox's Orange Pippin	9	0	,,	13	0
Ribston Pippin	10	0	,,	13	0
Five Crown	10	0	,,	12	0
Rymer	9	6	,,	12	0
Bismarck	10	0			
King of Pippins	10	0	,,	12	0

Pears.

	s.	d.		s.	d.
Winter Nelis..	12	0	to	22	0
Vicar of Winkfield	10	0	,,	13	0

For all good sound Cleopatras, Jonathans and Munro's Favorites of first grade from 12s. to 15s. per case was realised. For pears the Winter Nelis sold from 12s. to 22s., averaging perhaps 16s. per case. This variety is well suited for the English market and is a favourite dessert fruit, which will always command good prices if arriving in good order and condition. Vicar of Winkfield pears sold from 10s. to 13s. per case, the fruit not being very fine. Tasmanian apples realised from 8s. 6d. to 12s., a large proportion averaging about 10s. per case.

The Victorian fruit arriving yet, with a few exceptions, is stated by continental buyers to be hardly good enough in quality for their requirements, and, so far, only small quantities for re-shipment have been taken. Tasmanian they do not seem to care about. Recently some shipments of Canadian apples to England have been made in 40 lb. boxes, instead of barrels with 120 lbs., and writers in some of their trade papers have been advocating a general adoption of the smaller package, referring to the advantage it possesses over the barrel, and referring to its use by Australian and Tasmanian exporters. Some of these cases of Canadian apples sold this week realised only from 4s. to 6s., which would result in a loss to the consignors. Unless for cooking purposes, there is very little demand for American apples (except Californian or Oregon dessert varieties) when Australian and Tasmanian appear on these markets.

The "Ormuz" Fruit.

This steamer arrived with about 5,000 cases of Victorian apples and pears, and 14,000 cases of Tasmanian apples. The Victorian fruit was in good condition generally, but the pears, with the exception of a few cases of the Inconnue variety, were over-ripe and wasty. Some of these pears appeared to have undergone re-packing, and been bruised in the process. A considerable proportion of the consignment, outside of the favourite dessert varieties, Cleopatra, Jonathan and Munro's Favorite, were what might be termed second rate classes, such as the Reinette de Canada, Five Crown, etc., more suited for cooking purposes. Buyers will not give more than 7s. to 9s. per case for such apples as the Reinette, as there are always cheap American cooking apples to be had. Shippers will find there is a very little margin of profit in sending varieties which can only be used for cooking.

At the sales, Victorian fruit of good class realised prices equal to those of last week. Prices ranged as follows:—

	s	d		s.	d.
Apples.					
Cleopatra	12	0	to	15	0
Jonathan	10	0	,,	14	6
Munro's Favorite	9	6	,,	15	0
Rome Beauty	9	6	,,	10	6
Five Crown	8	6	,,	10	6
Rymer	9	6			
Reinette de Canada	8	0			
Pears.					
Vicar of Winkfield	4	6	to	11	0
L'Inconnue	–			16	0

The Shipment per "Orestes."

This steamer arrived with 4,300 Victorian apples and 350 cases of pears. I found, on inspection, that the apples, with the exception of a variety called Gloria Mundi, which had many decayed fruits in the cases, appeared to be generally in good condition. The Victorian pears, like those in the *Ormuz* were packed in apple cases, and several opened of the Capiaumont variety appeared to be either partly or wholly rotten. Another variety, name unknown to me, was, however, in sound condition. In the same chamber with the Victorian pears were 800 trays or small cases, each containing one layer of Tasmanian pears of the Bon Curé variety. These were in perfectly sound condition, shewing conclusively the advantage of the latter system of packing for this fruit, which I have strongly recommended to Victorian exporters for the past two years. The temperature of the chamber had been kept at 38 to 40 degrees. The fact that this system of packing pears is the most suitable under all circumstances cannot be too widely known to Victorian growers and exporters.

The prices per case for Victorian fruit were as under :—

APPLES.

	s.	d.		s.	d.
Cleopatra	10	0	to	13	6
Jonathan	10	0	,,	13	0
Munro's Favorite	10	0	,,	13	0
Esopus				12	0
Five Crown	10	0	,,	10	6
Gloria Mundi	10	0			
Other Varieties	8	6	,,	10	0

The "Oceana" and "Suevic" Shipments.

The *Oceana* shipment of fruit comprising 4,544 cases from Melbourne, 14,314 from Hobart and 1,206 from Adelaide, arrived and discharged all in good condition. Included in the Victorian consignment were 179 cases of pears. These were carried in a separate compartment temporarily bulkheaded off with one inch of pine boarding in the large refrigerated chamber, and the temperature kept at 38 degrees, the apples in other part being at 45 degrees. The pears, which were of the Vicar of Winkfield, Winter Nelis, Bosc and Calabash varieties, were in large cases, the various shippers adopting different methods of packing. Some of the pears wrapped in paper were packed in chaff, others in wood shavings, some simply in the paper wrapping, and a few cases had the fruit in card-board cylinders. All, however, were in sound condition, shewing, as with the *India* consignment, that this fruit will carry well if placed in a separate chamber to the apples and the temperature kept at 36 or 38 degrees, and that no special process is necessary to aid their preservation in transit. One precaution, however, should be taken by exporters of pears, and that is to reject any single fruit having a blemish, and to have it all handled and packed carefully so that none of it is bruised.

The apples, generally, were of a fine class, and freer from bitter pit than previous consignments.

The *Suevic* discharged 2,097 cases of Victorian fruit and 17,000 cases of Tasmanian, all in good order.

With regard to prices for Victorian fruit per *Oceana* and *Suevic*, they realised as follows per case :—

APPLES.

	Ex *Oceana*.						Ex *Suevic*.					
	s.	d.		s.	d.		s.	d.		s.	d.	
Cleopatra	10	0	to	14	0		10	0	to	13	0	
Jonathan	9	0	,,	12	6		9	0	,,	12	6	
Munro's Favorite	10	0	,,	14	0		—			—		
Rome Beauty	7	0	,,	9	6		—			—		
Cox's Orange Pippin	10	6	,,	—			—			—		
Five Crown	8	0	,,	10	6		8	9	,,	9	6	
Reinette de Canada	7	6	,,	8	6		7	3	,,	9	0	
Others	8	6	,,	10	6		7	6	,,	9	0	

PEARS.

	s.	d.		s.	d.
Winter Nelis..	12	0	to	15	0
Vicar of Winkfield	9	0	,,	10	6
Calabash	—			12	0

The fact that three shipments, having a total of nearly 70,000 cases, arrived and were offered for sale within five days, of course had a weakening influence on the market, with a reduction in prices from those realised last week. Portion of the shipment by the *Orestes* and *Suevic* have been taken on to Liverpool, but did not realise very high prices, partly owing, it is said, to the quality of the fruit, much of which was small, and, in the case of the former vessel, immature. The demand, however, was good, and Cleopatras realised 10s. to 13s. 6d.; Scarlet Pearmains, 8s. 6d. to 10s. 9d ; Alexander, 9s. 3d. to 11s. 6d.; Ribstons, 7s. 6d. to 10s. 6d.

A large number of trays of pears have come forward from Tasmania by the three steamers named, generally in very good condition, although not of what might be termed good dessert varieties. These trays, containing one layer of fruit, equal to about one-third of quantity contained in an apple case, have sold for 5s. per tray, and a few at 3s. 6d to 4s. The cold weather experienced has a certain influence on the fruit market, the general consumption naturally being less than under normal conditions. Reports received from Hamburg this week state that a direct shipment of Australian apples to that port realised from 12s. 6d. to 18s. 6d. per case, a satisfactory return to exporters. Considerable quantities have been purchased in Covent Garden this week for export to Hamburg.

There are still some Californian apples on this market, which sell from 9s. to 14s. per case. The fact that these, and also pears, have been kept in perfect condition in cold storage at the right temperature, 40 and 36 degrees respectively, since last October indicates that

little difficulty exists for dealing with Victorian fruit for a lengthened period. For home consumption in Victoria, and also for the supply of apples to other States, it is surprising that the American system of cold storage is not adopted. Growers in any district could co-operate to provide cold storage in any central position, and so preserve their apples and pears when prices are low until the season was over, and then realise remunerative rates in supplying the demand in other States or Eastern ports. Cold stores for fruit storage are now universal in the United States, and are looked upon as necessary for that product as for meat.

The Fruit in the "Orizaba"

A Partially Frozen Consignment.

This steamer brought 26,000 cases of fruit, the Victorian consignment consisting of 3,558 cases of apples, 2,192 of pears, and 84 of grapes. Although the larger portion of the shipment was landed in excellent condition, a considerable number of Tasmanian and Victorian apples, chiefly the former, were wet or frozen. In consequence of representations made by me to the Orient Company the cause of this damage is being investigated. It would seem that the shoots placed across the refrigerator chamber to catch the condensed moisture were leaking, and the drips passed down among some of the cases near the air trunks. There must, however, have been some material change in the temperature in addition, to have caused the frosting of the fruit, and this is being inquired into. It shows, however, that if self registering thermometers were in use in the chambers of vessels carrying perishable produce, the range of temperature would have been recorded, and if such as to cause damage to the product carried, a claim for loss would have to be paid by the shipping company. The fruit-growers and exporters of Victoria, Tasmania and South Australia might arrange through their Associations, before next season, to have a certain range of temperatures adopted by all shipping companies carrying their fruit to Great Britain, a minimum and maximum, say from 36 degrees to 44 for apples, and 36 to 40 degrees for pears and grapes, and have a uniform agreement or contract in connection with carriage of fruit at these temperatures and dry condition stipulated for. If a consignment arrived either in a partly frozen or in a over-heated condition resulting in damage, exporters would then be able to recover for loss sustained. When, as in the case of the *Orizaba*, a portion of the fruit arrives wet or frozen, purchasers at the Covent Garden auction sales use this as a leverage to reduce prices, expressing themselves to the effect that there is a doubt of the soundness of condition of the balance of the shipment. They also make every effort to exaggerate damage done, with a view of depreciating values.

The Victorian apples ex *Orizaba*, generally, were in sound condition, and the same may be said of the pears, which formed the largest consignment of this fruit yet sent from Victoria. A considerable quantity of the pears were wrapped in waxed paper, and the cases

were also lined with this material, as used under the Sutherland process. The balance were packed in the usual way, and, in point of condition, both were sound and in good order, with the exception of a few cases in a wasty or over-ripe condition. A few cases of pears were simply packed in chaff, no paper being used ; the fruit in these, in some instances, was rather over-ripe and did not realise a good price. The chaff keeps the fruit from being bruised, but would appear to be a substance which prevents the fruit from receiving the same amount of cold air as if only wrapped in paper in the ordinary way. The variety of pears embraced Winter Nelis, Vicar of Winkfield, St. Germain, Josephine, Napoleon, Marie Louise, Clairgeau, and Calabash. A large quantity of pears have been arriving from Tasmania by each steamer recently, packed in trays and generally in good condition. The grapes, packed in large cases in cork dust, were stowed in among the apples in the ship's chamber, and did not appear to be in very good condition. The chief engineer informed me that he did not know that grapes were being shipped, the result being that they were not kept separate and stowed near the air shoots, which would have been more favourable to their transportation. This is a matter to which attention has been drawn in previous reports.

The prices realised were as follows :—

Apples.

	s.	d.	s.	d.		s.	d.
Cleopatra	10	6	11	6	to	13	6
Munro's Favorite ..	10	6	12	0	,,	15	0
Jonathan	9	0	11	0	,,	12	6
Cox's Orange Pippin ..			9	0	,,	13	0
Five Crown			8	6	,,	11	0
Rome Beauty			8	6	,,	10	0
Reinette de Canada ..			8	0	,,	10	0
Newtown Pippin ..			9	0	,,	13	0

Pears.

	s.	d.	s.	d.	s.	d.		s.	d.
Winter Nelis ..	9	6	16	0	22	0	to	31	6
Marie Louise ..			14	0	16	0	,,	18	6
Josephine ..	11	0	15	0	16	0	,,	17	0
Calabash ..					8	0	,,	17	0
Vicar of Winkfield			7	6	10	6	,,	12	0
St. Germain ..					14	0	,,	17	0
Napoleon ..			7	0	10	0	,,	12	0
Clairgeau ..					6	9	,,	12	0
Bosc					6	9	,,	8	0
Broom Park ..					9	9	,,	10	0

Grapes.

The grapes, ex *Orizaba*, which have been sold at the time of writing, have only realised about 5s. per case. There is not the slightest reason why grapes should not be carried in sound condition from Victoria, if they are packed in trays and carried at the proper temperature as has been suggested in frequent reports. When stowed in among apples, and carried at a temperature which will not suit them, as has been proved in numbers of shipments during the past six years, they rarely ever arrive in sound condition, and sell for prices which

leave growers no margin of profit for their trouble. Frequent reference has been made to the necessity for altering these conditions if success is to attend the export of grapes in large quantities.

The Best Pears for Shipment.

Enquiries made from a number of fruit salesmen with regard to the best varieties of pears for the British market at this season of the year, resulted in the following information :—Winter Nelis are regarded as one of the very best dessert pears, and, if sound and well-grown, will always realise high prices in April and May. It carries well from California, where it is also looked upon as a good variety for the English market. Another good variety shipped from California to this country, and realising excellent prices, is the Doyenné du Comice. The Marie Louise, Glou Morceau, Josephine and Capiaumont, are also regarded as good dessert varieties for shipping, and sell well. The Vicar of Winkfield is identical with the pear shipped from Tasmania as Beurré Bosc, and is regarded only as a second-rate fruit, suitable for cooking. The St. Germain, a very large fruit, sometimes realises a high price at this time of the year for show purposes in fruit shop windows, but is looked on as a cooking pear, and this may be said of the Clairgeau also. I do not think Victorian growers can do wrong in extending their plantations of the Winter Nelis, as it seems to be a particular favorite with consumers in this country, and in consequence will realise a good price. Those which realised 31s. 6d. per case were grown by Mr. James Lang, of Harcourt. Some of the finest Munro's Favorite and Cleopatra apples were also from that district.

Shipments to the Continent.

Reports from Hamburg indicate that in the sale of direct shipment of Australian apples the demand for good Cleopatra, Munro, and Jonathan apples was keen, and prices, as stated previously, were from 12s. 6d. to 22s. per case. Very considerable quantities of the finest Australian apples are being re-shipped from Covent Garden to supply the Continental demand, and a buyer from Berlin during the week bought several hundred cases for his trade there.

Shipments sent to Hamburg can be sold on the dock without paying import duty, and re-shipped to any of the cities in neighbouring countries. This is an advantage possessed by Hamburg over other Continental ports where duties have often to be paid if the fruit is landed.

THE ORCHARD.

By James Lang.

Preparing the Land for Planting.

In preparing the land for planting fruit trees it is requisite that the whole of the ground should be deeply ploughed to a uniform depth of from six to eight inches, which will be sufficient where the ground is of a sandy or friable nature, but in heavier soils subsoiling will be necessary. This latter operation is best done by removing the mouldboard of one plough and following with it in the furrow behind the ordinary plough. In this way the subsoil is stirred up to a depth of about a foot, and the ground is left in good condition for planting. On no account should holes two feet or more in depth be dug in which to plant the trees, as these holes merely act as a receptacle for water to the great injury of the trees.

In breaking up virgin land that has just been cleared, it is advisable to crop it with hay or potatoes for the first season, or it may be left in bare fallow, which sweetens and mellows the soil, and leaves it in better condition for planting.

Planting.

The distance apart when planting trees, is a matter in which considerable diversity of opinion exists among fruit growers. In small gardens, where the space is limited, 15 feet apart is a fair distance; in commercial orchards, where the work is done by horse labor, 20 feet apart is not too much, this gives 100 trees per acre. In planting the tree dig a hole a little larger than the spread of the roots, so that each root can be laid out nicely, without being cramped, cut off all bruised or broken roots with a sharp knife, place the tree in the hole with the roots carefully spread out, fill in some soil, then tread firmly all round the tree, then fill in the remainder of the soil. The tree should not be planted deeper than the soil mark on the stem, this being the depth at which it was growing in the nursery.

Apples for Export.

In planting apples for export do not fall into the mistake of planting too many sorts, and of unsuitable varieties. Sufficient experience has now been gained from our exports, during the last ten years, to enable growers to select the varieties most suitable to the London market. Cleopatra, Jonathan, and Munro's Favorite always command the highest average price. Other good sorts are London Pippin, Dumelow's Seedling, Esopus Spitzenburgh, Newtown Pippin, Rome Beauty, and Sturmer Pippin.

In districts where the three first-named apples do well it would be wise to plant them only, because there is more money in them than in any other variety that can be exported.

Because an apple is a good keeper, it does not follow that it is suitable for export, it is far better, and more profitable, to grow apples that have already a good name in the London market, than sorts that, however good they might be, are not so well-known.

Suitable Varieties for the Local Market.

The following is a good selection of fruits to plant either for home use or local markets, arranged as nearly as possible in their order of ripening :—

APPLES.

Mr. Gladstone,	London Pippin,
Emperor Alexander,	Munro's Favourite,
Jonathan,	Rome Beauty,
Reinette de Canada,	Scarlet Nonpareil,
Cleopatra,	Rymer,
Esopus Spitzenburgh,	Stone Pippin.

PEARS.

William's Bon Chrêtien,	Marie Louise,
Doyenné Boussoch,	Anjou,
Capiaumont,	Broom Park,
Bosc,	Josephine de Malines.

PLUMS.

Early Rivers,	Washington,
Early Orleans,	Yellow Magnum Bonum,
Angelina Burdett,	Pond's Seedling,
Diamond,	Coe's Golden Drop.

APRICOTS.

Oullin's Early Peach,	Mansfield Seedling,
Royal,	Moor Park,
Hemskirke,	Dundonald.

CHERRIES.

Early Purple Guigne,	Eagles Seedling,
Burgdoff's Seedling,	Bedford Prolific,
Twyford Bigarreau,	St. Margaret.

PEACHES.

Briggs' Red May,	Crimson George,
Amsden's June,	Foster,
Hale's Early,	Lady Palmerston.

FIGS.

White Genoa.

GOOSEBERRIES.

Roaring Lion,	Crown Bob.

RED CURRANT.

La Versailles.

BLACK CURRANT.

Carter's Black Champion.

STRAWBERRIES.

La Marguerite,	Edith,	Trollope's Victoria.

Pruning.

Trees newly planted, if one year old, should be cut back to the height it is desired to have the stem of the tree, two feet is a good height. Two-year-old trees should have the branches cut back to from four to six inches to an outside bud, cut with a sharp knife, slanting upwards above the bud. Trees of older growth should have

the branches thinned out, and the main branches that form the framework of the tree shortened back, and, as a rule, cut off two-thirds of the growth of the current season's wood, leaving about one-third to form the framework of the tree. In pruning peaches it must be borne in mind that the fruit comes on the young wood, so that a fair supply of wood of the previous season's growth should be left to furnish a crop of fruit. Trees that have reached the full bearing stage, in addition to the shortening and thinning out of the branches, should have the fruit spurs regulated, by a judicious thinning and shortening back of the fruit spurs. It is a matter of complaint, with many orchardists, that some of their old trees, although they produce a heavy crop of bloom, fail to set their fruit, this is caused by the tree exhausting itself in blooming, and not having sufficient strength left to set a crop of fruit. One of the greatest offenders in this respect is the Winter Nelis pear, when old this variety becomes very thickly set with fruit spurs which bloom very profusely, then drop without setting any fruit; but if half, or two-thirds of the fruit spurs had been cut off, the bloom would have been stronger and a fair crop of fruit would have set.

If orchardists would carry out the above instructions with some of their old and unfruitful trees, the result would be a revelation to them.

THE LONDON MARKET FOR PRESERVED FRUITS.

By J. M. Sinclair.

Canned Fruit.

The consumption of canned fruits, especially apricots, peaches and pears, is largely increasing throughout the United Kingdom, chiefly due to the wide distribution of those exported from California. The care taken by the Californians in the selection of fine fruit for this purpose, prepared and canned in a faultless manner, and the sale of it at a price which put it in the power of the masses to purchase, has led to a large and regular consumption of this article. The fact that over £312,000 worth is imported from the United States, nearly all from California, will indicate how much their fruit-growers are benefited by developing this trade. This canned fruit is nearly all shipped by sailing vessels from California, the voyage being quite as long as from Victoria. During the past two years prices have not varied to any great extent, and, at present, the ruling quotation for Californian standard apricots, two and a half pound tins gross, is from 5s. 6d. to 5s. 9d. per dozen; and peaches and pears, 6s. 6d. per dozen; for 3 lb. tins gross, extra apricots, 7s. to 8s. per dozen. The two and a half tin is the most marketable size, and that in which the largest trade is done. The three pound tins contain a large fruit of better grade than the two and a half pound tin, and a thicker syrup is used. I submitted some samples of Victorian apricots and peaches to one of the largest London brokers, and he pronounced the fruit to be excellent, but stated that the syrup in the three pound tins was rather thin, the trade requiring it heavier. During the past two years canned pears have come into favor, and are preferred to the apricot, importers informing me that two cases of pears to one of apricots are now sold. The Bartlett or Williams' Bon Chrêtien is the best canning variety. The whole output of a Californian canning company is frequently bought up in advance, especially any which has earned a reputation in selection, grading and putting up in the best possible manner.

Californian companies are now forwarding considerable quantities of their fruit in glass jars, the finest peaches, apricots and pears only being used. These contain about the same quantity of fruit as the two and a half pound tin, but there are also some of a larger size. They are beautifully put up, and the demand for them is increasing, the price charged being about thirty per cent. higher than for the tinned article.

I think the time is approaching when Victoria will be able to enter into the trade of supplying canned fruits for British consumption, as prices are showing a tendency to gradually advance, since the Californian output, which is the principal one in the world, has met with a wide and sustained demand, but in any case there should be an outlet in the other Australian States and New Zealand.

Dried Fruits.

Apricots are imported from California, the first arrivals coming in December, being sent overland across the States in order to be in time for the Christmas trade. These are subject to a duty of 7s. per cwt. The fruit is packed in 25 lb. boxes, and realises generally about from 33s. to 70s. per cwt., according to quality. Present quotations for the different grades, c.i.f., London, are :—Ordinary quality, 33s. to 38s. per cwt. ; medium, 40s. to 45s. ; fine, 48s. to 55s. The freight from California to London is 6s. per cwt. During March last good Califonian sold at 62s., and South Australian at 58s., a little improvement taking place in April when some Mildura made over 60s. The trade in dried apricots is a comparatively new one in Great Britain, and, although it has not yet assumed large dimensions, possibly on account of the wide distribution of canned apricots, an increasing demand exists for a first class article. It remains to be seen whether good Mildura apricots will be able to compete with Californian, but if shipments are made, it should only be of the finest grade fruit.

Prunes are imported chiefly from the South of France, with some also from California, arriving about the middle of October. The quality is determined by the size and colour of the fruit. These are also dutiable at the rate of 7s. per cwt. They are packed in half-cases weighing 56 lbs. or quarter-cases of 28 lbs. I regard the Californian prune as superior to the French, and in that country great areas are placed under this fruit, in order to supply an enormous demand for this article from the Eastern States. In the Goulburn Valley, from what I saw in California, their varieties of the prune would do well. The Californian crop of dried prunes reaches the enormous total of 150,000,000 lbs., and the larger proportion is consumed in the States, although a very considerable trade has been developed with Europe.

Peaches come from California, packed in 25 lb. boxes, and there is no duty on them. Prices range about the same as for apricots, but so far this fruit is in limited demand owing to the excellence of the canned article.

In Raisins, Valencias sell at from 38s. to 40s. per cwt. ; fine, 48s. to 50s. ; and choice, at 55s. to 75s. Prices are higher this season on account of a short crop. Sultanas, ordinary, 40s. to 42s ; medium, 44s. to 46s. ; fine, 48s. to 50s. ; and choice, 55s. to 60s. Muscatels, ordinary, 40s. to 50s. ; medium, 60s. to 65s. ; fine, 85s. to 100s. ; on trays, 80s. to 110s. Duty, 7s. per cwt.

Currants, Vostizza, the finest range from 21s. to 40s. per cwt. ; other classes, from 13s. to 20s. The duty is 2s. per cwt.

DIRECTIONS FOR TOBACCO GROWERS.

By Temple A. J. Smith.

Transplanting.

The successful tobacco grower will have his field in thorough order by the time his plants are ready for putting out, *i.e.*, the land is well ploughed, if possible, to a depth of 8 or 10 inches, and well pulverised. It is wise to plough the intended tobacco patch late in the autumn, and again just before the plants are set out; this will give less trouble with weeds and insects later on, and will also bring the ground into better condition. In almost all cases it is well to roll the field after harrowing. The level field has proved the most suitable in Victoria, though if your land is excessively moist the American system of ridging might be advantageous—this means the throwing of two furrows together at distances of 3 feet 6 inches apart, then working the plough across the field at right angles at the same distance apart, leaving the appearance of a huge chess board. The plants are then set at the corner of each square. In our drier climate, however, this system is not to be recommended.

The usual plan followed here is to mark out the field into 3 feet 6-inch squares, with a marker made like a rake, with three teeth distant 3 feet 6 inches apart. This can be drawn by a man from end to end of the paddock, and afterwards at right angles, the corners marking the place for the plant. A line, with marks every 3 feet 6 inches, is also commonly used. It is very necessary to keep the rows of plants straight, so that later on the horse hoe or scuffler can be used without damage to the tobacco.

When the plants have leaves from two to three inches in length they are ready for pulling, and care must be used in doing this branch of the work not to injure either the heart of the plant or the root. The experienced grower will take the tips of the leaves in one hand, and with the other loosen the earth round the roots with a narrow-pointed stick. In this way the plant is drawn with few roots broken, and there are many particles of earth attached. If the soil is dry or hard, in the seed-bed, it is watered beforehand, generally over night, to allow the ground to soften. Plants should always be pulled the day they are to be put out, and kept in a cool, shady place until put in the ground. A basket, or large tin bucket, is generally used by the planter, and he is careful to keep all the roots of the plants together to the centre of the bucket, as this method facilitates the work, and helps to preserve the young plants.

In the field much depends on the amount of labor the planter has at his disposal for the system to follow. When men are plentiful, the general custom in Victoria is to have two men ahead with hoes to chop up the ground where the plant is to go, two more follow putting

in the plants. If the ground is in first class condition, little or no hoeing is required. In placing the plant in the ground, the operator, either with a stick pointed at one end, or with his fingers, makes a hole about 4 inches deep, in this he places the roots of the plant, being careful not to have them doubled, he presses the soil firmly round the root, leaving the surface round the stem free. Each planter takes two rows through the paddock, planting first on the left and then on the right as he proceeds. Should the ground be dry, each plant should be given a pint of water in the evening, and if the sun be very hot or hot winds be blowing, a slight covering of grass or light material should be placed over the plant, to be removed when it is well established.

A good man will plant an acre in two days, but the usual allowance is one acre in three days. Tobacco planting machines are much used in some parts of America, and have been found a saving in expense and time. It is a two wheeled machine drawn by two horses, it requires a man to drive and two boys to drop plants, and will set from three to six acres per day; it carries a supply of water and each plant is moistened under the surface as planted, and is said by those who have used it, to do the work, in well prepared land, better than hand labor. After the first planting is over, it will be necessary to replace those that do not take, of which there will always be a proportion, according to the season and the state of the ground. Cut worms also attack the young plants, but they should not be numerous if the ground has been well worked during the winter, and the weeds kept down.

When the plants are well established, the horse-hoe should be freely used between the rows, and the soil immediately round the plant gently loosened with a light hoe or knife.

STINKING SMUT EXPERIMENTS.

By D. McAlpine.

The Plan Adopted.

Experiments were again carried out in the prevention of Stinking Smut, and the three substances which had given most successful results in the past were tried, viz., bluestone, formalin and corrosive sublimate.

In a previous experiment, 1,000 grains of the same variety of wheat were taken for each treatment, but in this instance a bulk sample was treated, and an ordinary farm drill was used to sow single strips for each plot the full width of the drill and one chain in length, so that the conditions closely approached those in existence on an ordinary farm. The test, however, was naturally much more severe than it would be in ordinary practice, for the farmer does not generally sow seed which is visibly affected with smut, while here the grains were all so coated with smut spores that they looked quite black.

The badly smutted grain chosen for the purpose was damped and then the seed wheat, Queen's Jubilee, was thoroughly mixed with this, so that every grain received its coating of smut-spores. Though special care was taken to break the smut-balls, some doubtless escaped, and this would account for the presence of a small amount of smut in the crops, the seed of which had been treated. The smut-balls are unacted upon by the substances used, and they would afterwards be crushed in the drill when the seed was sown and thus serve to reinfect the seed.

Methods of Treatment.

1. Bluestone or Sulphate of Copper.—It is essential for the success of the treatment that the genuine sulphate of copper be used, and not the so-called agricultural bluestone which is sometimes sold, consisting largely of green copperas or sulphate of iron. In my report for the year 1900, it was shewn as the result of experiment, that the sulphate of iron cannot be relied on to destroy the spores of stinking smut.

The bluestone was used at the rate of 1 lb. to every 5 gallons of water and when thoroughly dissolved, the infected seed enclosed in a bag, was dipped for a minute or two, till all the grain was thoroughly wetted, and then hung up to dry over-night.

2. Formalin, which is a liquid, was used at the rate of 1 oz. in $6\frac{1}{4}$ gallons of water, that is a proportion of 1 in 1000, or 1 lb. in 100 gallons of water. The seed was dipped for a few minutes, and remained in the wet bags over-night. It was then allowed to dry before sowing.

3. Corrosive Sublimate or Mercuric Chloride is a very poisonous substance and therefore requires great care in the handling. It was

used in the proportion of 1 in 1,000, that is 1 lb. in 100 gallons of water, and after being thoroughly dissolved, the infected seed-wheat was immersed in it, as in the case of formalin.

The following morning, when the seed was dry, the plots were sown with an ordinary farm drill in single strips alongside each other.

4. Check Plot.—There was a check plot of equal extent to the others in which the infected grain was sown without any treatment whatever, so that the effect of the various treatments on the resulting crop could be compared with each other, as well as with the untreated.

Results of Treatment.

In order to estimate results on such relatively large plots, it was necessary to adopt some plan whereby the proportion of clean to smutty ears could be approximately determined. Accordingly, two strips, the width of the plot, were selected at some distance from each other and one yard in length. The total ears were counted in each strip, and an average of the two taken, then this sum was multiplied by the length of the plot in yards, thus giving a sufficiently close approximation to the total number of ears in the plot. Next the smutted heads were counted in each treated plot, which were searched three times for smutty ears in order to ensure accuracy. As the crop was just fully ripe, the smutted heads were easily detected among the clean ears, and under the conditions that existed there was no probability of any appreciable error.

In the check plot a different method of counting was adopted, as almost every ear was smutted, and numerous small patches were selected at random. In this way an average of 910 ears were found smutted in every 1,000 counted—that is, 91 per cent. of smutty ears.

This mode of reckoning was found to be unsuitable for the treated plots, because the smut there was so scanty that large stretches were absolutely clean. Thus in the plot treated with formalin, after counting two lots of 1,000 heads each, none were found diseased, and only 232 smutty ears were picked out of the whole plot.

In order to allow for smutty ears in the treated plots overlooked or undiscovered, 10 per cent. was added to the actual number recorded, so that the relative merits of the different fungicides used are approximately shown. The results were as follows :—

Bluestone ..	1 lb. to	5 galls.	$\frac{1}{12}$	per cent. of smutty ears		or 1 in	1,214
Corrosive sublimate	1 lb. to 100	,,	$\frac{1}{7}$	,,	,,	,, or 1 in	732
Formalin ..	1 lb. to 100	,,	$\frac{1}{3}$–$\frac{1}{4}$	,,	,,	,, or 1 in	366
Check Plot ..	..	..	91	,,	,,	,,	

Remarks on Results.

The advantage of the treatment of the seed for stinking smut stands out clearly in these experiments. Bluestone proved the

most successful, with only $\frac{1}{12}$ per cent. of smutty ears, while formalin treatment gave $\frac{1}{3}$–$\frac{1}{4}$ per cent. In a previous year, when the experiments were conducted on a smaller scale, these three substances entirely prevented the appearance of smut, and I am inclined to think, as already hinted, that some smut balls may have escaped crushing, and thus the treated seed would be re-infected when sown with the drill. In this event it is probable that the bluestone treatment would largely preserve the grain from infection as a considerable quantity of the material adheres to the seed.

In *Guides to Growers*, No. 44, dealing with Bunt or Stinking Smut of Wheat and its Treatment, it was shown that when smutty wheat was dipped in kerosene tins and the smut-balls carefully skimmed off, there was no infection. The bluestone treatment has been proved effectual against stinking smut, but it has the serious drawback to the farmer of being rather injurious to the seed-wheat. Formalin has an advantage over bluestone in this respect, and it is well worthy of being given a trial in the treatment of seed-wheat for stinking smut.

In the United States of America, where the Agricultural Experiment Stations have tested a number of different methods for the treatment of this smut, it is now recommended to sprinkle the grain thoroughly with formalin at the rate of 1 lb. to 50 gallons of water, and leave it in piles over night before sowing. In our experiments only half this strength was used, that is 1 lb. in 100 gallons, and no doubt there would be an increased efficiency from employing the stronger solution. Formalin may be procured from Messrs. Felton, Grimwade and Co. or Rocke, Tompsitt and Co., Melbourne, at the rate of 2s. for 1 lb. bottles, or 18s. a gallon.

FROZEN POULTRY IN SOUTH AFRICA.

By J. Kirk Hunter.

The Position and Prospects of the Trade.

I have just obtained a return of the imports of frozen poultry into Cape Colony for 1902, and find, as I had expected, that they show a marked increase on those for 1901, and although Victoria has participated in that increase, yet she has not done so to the same extent as the United Kingdom, which now tops the list.

The following is a comparative statement of the imports for 1901–2.

Country whence Imported.	Value. 1901.	1902.
United Kingdom	£3,379	£10,038
New South Wales	2,606	3,058
New Zealand	109	284
Queensland	3	485
South Australia	—	172
Victoria	7,376	8,257
Natal	—	385
Argentine Republic	—	714
Tasmania	—	6
Canada	—	215
	£13,473	£23,614

This is a very fair increase, but it is small as compared with that of Natal, the value of whose imports for the year 1901 was £17,720, but for the nine months ending September 30th, 1902 (the latest return available), they amounted to the considerable sum of £44,656. I am unable, at present to secure the returns of the Transvaal, as in that Colony and Orange River Colony, the classification is different, poultry being included with meat, but I have no doubt whatever that they will show an even higher increase than Natal, especially the Transvaal, as Johannesburg is recognised as a big market for poultry and game of all kinds.

These returns, such as they are, indicate clearly enough that the African trade in poultry is at present one of considerable dimensions, and is rapidly increasing. The regrettable feature of the figures is that Victoria, which, in 1901, was at the top of the list, with a trade more than double that of the United Kingdom, which was next highest, is now second on the list, although showing an increase of trade equal to about 12 per cent. as against the big increase of the United Kingdom of over 200 per cent. This reversal of positions is not satisfactory, and it is regrettable losing our pride of place, especially as it is attributed to the superior quality and better value obtained elsewhere. Being endowed so prolifically with unexcelled climatic conditions, with—in normal seasons—ample supplies of cheap feed, regular and frequent facilities of transit, together with the excellent

arrangements for grading, inspection, and packing, Victoria should not only maintain but improve her position against all competitors. That this has not been done can hardly be explained by the drought, which seems to be seized upon as sufficient justification for all the ills and defects of all our products.

Big as this trade is at present, it possesses a potentiality that warrants the breeders for export in enlarging the scope of their operations, and should induce shippers to bestow every care, thought, and attention upon the condition of the birds and method of killing, preparing, packing, &c., so that they may open in the most satisfactory manner possible. That this has not always been the case in the past, I have had numerous instances to prove during the course of my enquiries.

Many good shipments have, of course, been received with which no fault could be found. Of these we hear very little. They are taken as a matter of course, and from the buyer's point of view it is not policy to be complimentary about a purchase, even if he feels it is deserved. It is about the bad stuff of which, unfortunately, there have been instances, that we hear most, and it is marvellous how rapidly the knowledge of one inferior consignment spreads, and how it is calculated to create the opinion that the uniformity of quality and condition of Australian poultry cannot be relied upon.

The products of high grade suffer from the defects of the inferior sorts, and so I argue the need of some arrangement for the equalisation of the conditions of export, and the issue of a uniform Federal certificate.

Russian Poultry.

Referring to the statistics already given, and noting the big increase in the value of the imports from the United Kingdom, it must be understood, the amounts mentioned do not represent English bred poultry; it is mostly Russian, shipped by English firms.

The Russian poultry is unquestionably the most popular in the African market at the present time, and anyone not biassed must admit deservedly so.

The reasons are plain and unmistakable. In the first place it is obvious the birds have been bred and fed specially for export, as they proclaim great equality in size and weight, which average just abou three pounds each. They are mostly small framed birds and at this weight are plump and fleshy. They are also plucked with evident care, all feathers and stubble and every particle of down possible being removed. They are neatly trussed with the head and neck wrapped in white paper and tucked under the right wing.

When killing they make a deep incision in the neck, close to the head, after dislocation of the neck, which promotes thorough bleeding, and I think accounts for the clean, white and attractive appearance of the flesh. They have a high reputation for tenderness and flavour

when cooked and those I have partaken of were deserving of credit in both respects.

The first shipment of Russian fowls that I saw were packed in cases containing one hundred birds, but this is too big as many of the retailers have very limited cool chamber accommodation; consequently a big risk of loss was taken by buying a full case of 100. To meet this objection, the cold storage companies had to open cases and take therefrom whatever quantity was required by the client. This meant a lot of handling and the risk of depreciation. They have, therefore, in their recent shipments been packing in smaller cases of 12 and 24 birds each. These cases are better than Victorian. They are made of heavier timber. Each case has five one-inch auger holes at each end, which allow ample ventilation. These holes are covered inside the case with a fine mesh wire gauze, which, whilst not retarding the current of air, prevents the intrusion of vermin, insects and dirt.

In Fitch's English packing, which is considered the best, there are 18, 20, 22 or 24 birds each in small square cases, which are strong and protected in the way above described. These birds are also very cleanly plucked and carefully packed, each is wrapped in a light brown or buff coloured paper, but this feature I do not like, nor is it appreciated in the trade, as when thawing the paper clings to the fowl and cannot be easily removed; thus giving the bird an unattractive appearance that depreciates it in the eyes of buyers.

Canadian Poultry.

To say that we hear a good deal of Canadian poultry and that considerable orders are being secured for it, would seem to be scarcely justified by a glance at the small value of imports for 1902. This amount, however, represents merely the first sample shipments which arrived hear about the end of the year, and which having made a very favourable impression on those who tried it, fairly large repeat orders have in many instances been given, and next year's statistics will tell quite another story so far as the importation of Canadian poultry is concerned; always of course provided they maintain the standard of quality of the preliminary shipments, which, I should say, they are not likely to depart from.

In plucking and packing they evidence that great care has been taken, and the flesh possesses a rich creamy plumpness that makes them very attractive. They are frozen with the legs fully extended, which method is favored by many of the retailers, as it enables them easily to make an attractive window display by suspension from a rod. They are packed twelve in a case 18½ in. deep, 4 in. wide and 2 ft. 7½ in. long, with neck and feet alternately reversed.

Generally speaking the Canadian fowls are much bigger than the Russian. I saw one shipment of magnificent birds, Plymouth Rocks, and the cases of 12 fowls each averaged 61 lbs. net. They were young, tender and exceeding attractive, and commanded a ready sale,

although they cost f.o.b., Montreal, 9d. per lb. Repeat orders, however, have been accepted at 7½d. The maintenance of the same standard of quality and packing as these, cannot fail to command a big business.

Defects in Australasian Shipments.

Birds from New Zealand have also been shown me at times as being better than ours, but so far as I have seen we have nothing to learn from that Colony regarding this trade. In most respects our production will fully hold its own with theirs. If anything, probably theirs are plucked cleaner than Victorian, but they possess the same fault of discoloration. As regards Victorian fowls, one is compelled to admit, even regarding the best of them, when they are seen on the poulterer's slab sandwiched between the Russian and Canadian that we have still something to learn, and that we are at best but third in the race for the trade.

Most of our fowls are well-conditioned, but owing to ineffective bleeding, they become badly discoloured, showing numerous black blood clots, and their appearance alone creates a comparison that is dead against us. This defect is stated also to shorten the period of their wholesomeness after being exposed for sale. The leading poulterer here informed me that he can depend on the Russian and Canadian fowls to keep fresh and sweet from the time of opening the cases, for at least five days, whereas in the Australian, decomposition sets in after the third day.

Another cause of complaint against Australian poultry is that of irregular grading. One large importer in Durban assured me it was no uncommon thing to have four or five different weights in a case of 15 birds, and I have myself seen a 3½ lb. fowl in juxtaposition with one of 2½ lbs.

A merchant showed me an invoice for 1,000 Russian young fowls, averaging 2½ lbs each, and he assured me that from experience he was justified in asserting that if the whole lot were weighed individually, that the variation would not exceed one or two ounces at the most. This is explained by the fact that they are all of one breed, they are mostly hatched about the same time, they are fed and fattened on the same kind and quantity of food, consequently there is great evenness of growth, development and weight. The weights most preferred are from 3 to 3½ lbs. each.

The Range of Prices.

It frequently happens that some little defect in the preparation of an article is atoned for by a reduction of what may be considered the standard market quotation, but in the question of price as in other matters, we are at present at a disadvantage with other countries.

Canada quotes now 7½d. per lb.
Russian Fowls, 3 lbs., London packed, are 4s. to 4s. 6d. per pair C.I.F.
Victorian, 3 lbs., 5s. to 5s. 6d. per pair C.I.F.
New Zealand, 3½ lbs., 4s. 9d. to 5s. 3d. per pair C.I.F.

Other Classes of Poultry and Game.

For all classes of poultry there is a good and constant demand, and I am glad to report that the ducks received from Victorian shippers give every satisfaction. Everywhere I have called I have enquired the opinion of these, and in every instance it was of a complimentary character. Our turkeys are also well regarded, and a bigger trade should be done in them. The trade at all the leading African centres is large and increasing, and in Johannesburg there is a big demand for poultry and game of all kinds. I think a fair business could be done from Victoria in pigeons well packed in cases of say 50 or more each. Wild duck would also command a ready sale.

The trade in hares and rabbits has not yet attained very large dimensions, but there is a fair demand, and it will steadily increase. Victorian shipments are well regarded, and we should always be able to maintain a fair share of the trade.

How to Improve Our Position.

In this poultry trade of Africa fowls are, of course, much the biggest item, and they frequently form the criterion of value of all the other items. Whoever does these well in point of quality, condition and price, is pretty certain to secure the clients orders for his requirements in other lines, but to fail with fowls, for any reason whatever, means frequently barring the door to other business.

I sincerely trust Victorian farmers and other poultry breeders for export will attach due importance to the immense field that exists for their products here, and that they will, by breeding a good and suitable class of poultry, and by feeding and fattening them on some recognised plan, enable the shippers to secure a much larger share of the trade.

The shipper must see to it that the prices are such as will enable us to successfully compete with other countries, and the experts of the Department must see that the other points in which we are at present deficient are remedied, viz. :—

(a) Closer attention to grading, with the view to securing, as far as possible, uniformity of weight.

(b) More careful plucking and cleaning, together with more effective bleeding, to improve the appearance of the birds.

(c) Better cases, ventilated in the way I have described.

As regards packing, I feel sure that any firm who will go to the small expense of wrapping each fowl in thin white muslin, such as is used for inner meat wrapping, will find it greatly improve their appearance when opened here, and repay them for the trouble.

I think, also, it would be an advantage to use a distinctive brand for poultry as is done for butter.

I have had my attention drawn to the frailness of the Australian cases, many of which are scarcely fit to stand the somewhat rough handling they receive at the African ports. I have seen them in various stores falling to pieces, which occasions unnecessary handling of the contents, and the risk of depreciation. The Canadian and English are both stronger cases, the latter of which I have already described, and it is the correct kind of case to use to insure the poultry opening to the best advantage.

I trust what I have written may be some help to Victorian breeders and shippers of poultry in assisting them to know the present position of the trade here, and how to cope with it, and that when the statistics of imports for 1903 are published it will be found that Victoria has regained her position as principal supplier of the poultry imported to South Africa.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. VIII.

Lung Worms in Sheep.

Lung worms when present in large numbers may cause the death of lambs by blocking up the windpipe and bronchial tubes. The air, when the tubes are blocked, cannot enter the lungs in sufficient quantity, and the animals die of suffocation. The worms may also set up, by the irritation they occasion, inflammation of the lungs. A large amount of secretion is found in the bronchial tubes of infested lungs, and in this secretion large numbers of the worms are present. This excessive secretion also assists in blocking up the air passages and aggravating the symptoms.

Treatment.

Treatment will not avail much when the worms have surrounded themselves with fibrous capsules, or when they have taken up their residence in the finer bronchial tubes. Not much chance of cure is then to be expected from the internal administration of drugs. Drugs, which might be effective when brought into direct contact with the worms, are valueless in the treatment of a disorder where their action can only be of remote application.

As a rule the drugs used to destroy parasites owe their virtue to their local action. When they come into direct contact with a parasite they either kill it outright or paralyse it so that it releases its hold of the mucous membrane to which it had attached itself. Santonin, for example, when given with proper precautions, readily causes the death of round worms inhabiting the intestinal tract. Bisulphide of carbon kills parasites inhabiting the stomach. Upon the pathology of the condition depends the treatment. If the worms are lodged in fibrous nests, or have gained the remotest ramifications of the bronchial tubes, no treatment can effect much benefit. As it is, of course, impossible in any individual case to decide the pathology whilst the creature is still living, it may not be inadvisable to give such expectorants as carbonate of ammonia and ipecacuanha in order to see whether their administration will bring about relief or assist in cure. Inhalations of ammonia provoke coughing, and thus aid the expulsion of both the retained secretions and the worms. If the lambs affected with lung worm are valuable, the best treatment would consist in the administration of carbonate of ammonia, 10 to 15 grains thrice daily, and also in daily submitting the animals to the fumes of sulphur. A well-built stable or suitable room of any kind should be used for the purpose of storing up the sulphurous fumes. All cracks and ventilation apertures should be blocked up. Sulphur moistened

with spirit should be placed on an iron vessel or shovel over a bucket of water, and the lambs should be fastened in the room; the sulphur is then ignited, and the doors securely closed. After the lambs have inhaled the fumes for about fifteen minutes they should be removed to the fresh air. Violent coughing will be set up by the irritant effects produced, and many of the worms will be expelled. Formic-aldehyde gas should be given a trial as a remedy to promote the expulsion of worms from the air passages. To generate formic-aldehyde gas, formalin tabloids are vaporised in an alformant lamp, and the lambs are subjected to its influence in a close room for from three to five minutes. The inhalation treatment, whether by ammonia, sulphur, or formic-aldehyde, should be practised daily, and abandoned when there is no longer any difficulty of breathing on the part of the animal.

Sheep grazing over soils rich in common salt are particularly free of lung worm. Salt is a parasiticide. Lung worm does not prevail in salt-bush country, and in such districts fluke also is absent. Animals affected with lung worm should be isolated in a high, dry paddock remote from water courses, and the water furnished for drinking should contain common salt and sulphate of iron. Lung worm prevails in damp, marshy localities and is particularly rife in wet seasons. Marshy lands are not suitable for sheep. There they not only contract lung worm, but fluke and foot-rot. Lung-worm, fluke and foot-rot are the scourges of marshy land. In the high, dry, sandy places sheep thrive best. It may happen in the course of time that from the utilisation of marshy lands for other purposes than grazing sheep, or from a proper system of draining and treating such lands, lung worm may become less common. It is only on marshy lands that the disease is contracted, and removal of sheep from infested areas may in the course of time be the step that pastoralists will adopt. By annually burning off the pastures of places known to be infested, the embryos may be destroyed. In cattle, pigs and dogs, the worms are almost always found in the trachea or windpipe, and expectorants, along with inhalations of ammonia, sulphur, etc., will cause their expulsion by the fits of coughing which the remedies excite.

Gapes in Fowls.

The parasite that causes this disorder is the *Sclerostoma syngamus*, a red cylindrical worm. The male is from $\frac{1}{12}$ to $\frac{1}{4}$ of an inch, and the female from $\frac{1}{2}$ to 1 inch long.

Symptoms and Treatment.

The fowls are noticed roaming about with wide open mouths and making straining efforts, as if endeavouring to expel the invaders, and making a low peculiar noise.

Treatment consists in the mechanical removal of the imprisoned worms. Take a feather and strip it to within about an inch of the top, and dip it into oil of turpentine. Sieze hold of the tongue of the

bird and draw it forward, the opening of the windpipe is thus brought within easy reach. Now introduce the oiled feather into the windpipe and carefully twirl it round and round, by this procedure the worms are detached, and on withdrawing the feather they can be seen adhering to it. Turpentine, being an irritant to the mucous membrane, excites coughing, and by the act of coughing any worms not removed by the agency of the feather are urged to leave the windpipe of their hosts. When the fowls breathe with their mouths shut, and by their no longer making straining efforts, it can be concluded cure has been effected.

The water given to fowls to drink, when an epidemic of "gapes" prevails, should be drawn from taps and renewed daily. If tap water cannot be given them, water drawn from ponds or wells should contain salicylate of soda in the proportion of 3 teaspoonfuls to a quart. Salicylate of soda kills the embryos, and it is not inadvisable to put a little of it into every drinking vessel. All birds affected should be isolated and kept in as small an enclosure as possible, preferably one with a brick floor. The floor should be washed daily with strong solutions of phenyle, as this destroys the coughed up worms and embryos. Poultry should be kept off marshy places as it is in such spots that they pick up the embryos, either free, swimming or enclosed in the bodies of snails, &c.

TWO YEARS' FIELD WORK OF THE CHEMICAL BRANCH.

By F. J. Howell, Ph. D.

(A Paper read before the Shepparton Conference, July, 1902.)
Continued from page 14.

PART 2.—THE CENTRAL, SOUTHERN AND WESTERN DISTRICTS

We can pass now to the soil requirements of the Central, Southern, and Western districts, and shall find problems in each case of far greater complexity. The one crop, or one class of crop of the North gives place to variety—an unbroken succession of the same crop is replaced by systems of rotation, and soil uniformities are lost in soil diversities. Climatic conditions also reveal differences equally as marked. All these differences have their influence on the matter of manuring. A heavier rainfall admits of much heavier crops, and as the greater the crop the greater the quantity of plant food removed from the soil, soil exhaustion becomes more rapid and more pronounced. The system of farming also adopted on the various holdings will each show its effect. Carefully thought out rotations might even, in certain respects, add to the fertility of the soil. We know how the inclusion of a pea, bean, or clover crop might add to the nitrogen in the soil; or how the repeated removal of root crops might exhaust it of its available potash. In older settled districts then, with a rainfall admitting of heavy crops, with various systems of farming and soils showing large natural variations it will be difficult or impossible to prescribe a system of manuring that might apply to every farm and every crop, as it practically does to the Northern area, but, even admitting this, there might be a feature common even to the soils of all these farms, and our experiments, few as they are, allow us, with a certain measure of certainty, to say what this is. The only soil deficiency requiring consideration in a system of manuring in the North was found to be phosphoric acid. The soil deficiency requiring the most, though not the only, consideration in our Central, Southern, and Western districts, is, if our experiments are sufficiently numerous to allow us to generalise, also one of phosphoric acid. There may be soils where this is not so, but these may, I think, be regarded as exceptions. An examination of the tables will show the dominant influence of phosphoric acid in the manures used even on the soils of these areas. It will be seen from the tables of the Central district that I have given the results of seven tests. The first three plots have been treated with a complete manure, that is a manure containing the three ingredients, nitrogen, phosphoric acid and potash. The No. 1 is a light dressing; No. 2, twice the quantity; No. 3, three times the quantity. On No. 4 plot, nitrogen has been left out of the complete manure; on No. 5 plot, phosphoric acid; and on No. 6 plot, potash. That is on plots 4, 5 and 6, manures containing only two ingredients each have been given. Turning to the results of the complete manures of plots 1, 2, and 3, it will be found that the

medium dressing gave the heaviest increase—over one ton to the acre. This alone is of interest, as showing that it has been possible on the soils of this district, regarded as of great natural fertility, to still further increase the yields, through the application of manures, by more than one ton. The yields of some of the unmanured plots of these soils reached nearly three tons per acre. Coming to plot 4, where nitrogen has been left out, and comparing the increased yield with plot 3, where it has been given, it is seen that leaving nitrogen out of the manure has resulted in a loss of four cwt., an indication that nitrogen manuring has slightly benefited these soils. The same thing also appears on plot 5, where potash has been left out, but not quite to the same extent, as the loss here is slightly over three cwt.

TABLE C.—SHOWING INCREASED YIELDS IN LBS. DUE TO MANURING IN CENTRAL AND SOUTHERN DISTRICTS.

Number of Plot ..	1	2	3	4	5	6
Manure Applied ..	Complete Manure containing Nitrogen, Phosphoric Acid, and Potash.			Manures containing Two Ingredients Only.		
	Light Dressing.	Medium Dressing.	Heavy Dressing.	Phosphoric Acid & Potash. No Nitrogen.	Nitrogen and Potash. No Phosphoric Acid.	Phosphoric Acid & Nitrogen. No Potash
Hay Crops in Central Districts.						
C. Carling, Smeaton ..	660	2,320	1,980	2,900	2,040	800
A. Archibald, Smeaton ..	1,120	3,580	3,980	1,240	1,580	2,840
John Stanley, Smeaton ..	1,760	2,440	1,780	1,480	360	1,440
Thos. Fletcher, Blampied	1,480	2,920	4,140	2,140	820	2,640
Mr. Yelland, Newlyn ..	918	1,209	2,150	1,209	425 loss	1,321
,, Wittowski, Wallace	2,240	2,576	739	2,800	537	3,740
,, And. Wade, Bullarook	1,052	1,388	1,523	1,590	313	1,209
Average of 7 fields in lbs.	1,318	2,347	2,327	1,908	746	1,998
Hay Crops in Southern Districts.						
D. Topp, Bunyip ..	200	1,720	3,360			
G. Marshall, Garfield ..	720	1,640	1,820	580	100	860
Mr. Barker, Garfield ..	1,460	2,280	2,200			
C. Pitt, Garfield ..	1,180	2,880	2,400	1,400	400 loss	800
J. Conobeo, Jeetho ..	200	470	2,880			
S. S. Clements, Whittlesea	2,020	3,280	3,400	2,000	560	2,100
Geo. Answers, Nowa Nowa	1,860	2,040	3,100			
Mr. Henry, Drouin ..	761	1,344	2,016	963	1,276	3,337
,, Brooks, Sth Warragul	918	1,276	1,657	1,366	985	1,344
Average of 9 fields in lbs.	1,035	1,881	2,537	1,262	504	1,688
Potato Crops in Southern Districts.						
Mr. T. M. Whelan, Swan Reach	4,323	6,787	8,736	7,884	2,105	5,308
,, Simpson Hill, Bunyip South ..	156	3,808	5,443	1,836	492	2,016
,, C. H. Mann, Macclesfield	2,732	3,808	7,929	3,068	291 loss	3,920
Corke and Ind, Woori Yallock	627	5,308	4,704	1,075	694	3,852
Average of 4 fields in lbs.	1,959	4,927	6,703	3,465	750	3,774

Taking the increased yield on plot 6, a fact of great significance becomes at once apparent. The leaving out of phosphoric acid in this plot has resulted in a loss of 1,571 lbs. A feature then common to the supposedly fertile soils of this district is, as with the Northern, a marked deficiency in phosphoric acid, but the similarity ends here, for in the Northern soils an application of a manure containing phosphoric acid only, gave practically the possible limits to an increase in the wheat yield, while in the soils under review nitrogen, and, to a less degree, potash seemed also necessary. On such soils, generally speaking, an application of

$1\frac{1}{2}$ to 2 cwt. ordinary superphosphate,
1 cwt. nitrate of soda,
$\frac{1}{3}$ cwt. potash chloride,

ought to result in an increase of from 1 ton to 30 cwt. of hay per acre the first year. What the after profits might be the second year I will call attention to later on. Of course, I know there are farmers in this district who will maintain that such a complicated, and such a heavy dressing of manure is by no means necessary, and that yields almost as great can be secured by an application of phosphoric acid only, in the form either of superphosphate or Thomas' phosphate. If actual weights were taken it would be found, judging by our experiments, that the estimated increased yield due to a superphosphate or Thomas' phosphate alone was in excess of what was really obtained; for, in our experiments, we find where superphosphate only has been used that the yield is only half of what it is with the complete manure, and there is every reason to think that, by a system of continuous hay growing with a superphosphate only the ground would soon become exhausted in the other ingredients. The object of manuring is not only to obtain large increases for a few years, but also to maintain the fertility of the land, and there are strong reasons for thinking that in the Central district we must use a complete manure to do this, always giving our manure containing phosphoric acid the first consideration. Of course, by rotating our crops, instead of growing hay continuously, and including a pea crop in our rotary courses, the necessity of nitrogen manuring would, possibly, be done away with, and all we should then have to give would be a superphosphate with a little potash chloride.

All that we have said of the soil requirements of the Central districts seems to apply just as well to the more Southern portions of the State. On referring to the same tables (Southern districts) it will be found that the system of manuring in the fields has been just the same as in the Central districts. On the first three plots a complete manure has been used; and the increased yields from these plots can be compared with the increased yields on plots where one of the three ingredients forming the complete manure has been left out. The results in the first part of the tables are also those of hay crops. A complete manure, taking the average of nine fields and the figures of the plot with the medium dressing, has resulted in an increase of 1,881 lbs. On the plot with the heavy dressing the increase has

exceeded the ton. There are five fields only in this district where we have the full results for comparison. The average of these five fields on plot 3 is 2,084 lbs. increase. Comparing this with the increased yield on plot 4, where nitrogen has been left out, we find there has been a falling off of 7⅓ cwt. On plot 6, where potash has not been included, the reduced yield amounts to approximately 4 cwt.; while on plot 5, where phosphoric acid has been left out, the loss amounts to over 14 cwt. The Southern soils, so far experimented on, show then, like the Central, phosphoric acid as their dominant deficiency as far as the hay crop is concerned, and to the point that the small number of results allow of generalisation; while the benefit of both nitrogen and, to a less extent, potash manuring seems apparent.

Results in Potato Manuring.

Experiments have also been carried out in the manuring of potatoes in the Southern districts, as shown in the same tables, and the results so far, taking the average, seem to confirm those of the hay crop. It will be seen, on reference to the tables, that a complete manure medium dressing has resulted in an increase of 4,927 lbs. of potatoes. Where nitrogen has been left out there has been a loss of 13 cwt.; potash of 10⅓ cwt. (nearly), but the omission of phosphoric acid in the manure has resulted in a loss of over 37 cwt. to the acre.

The few experiments that were carried out last year in the Western district have given most gratifying results, as is evident in the following tables:—

TABLE D.—SHOWING INCREASED YIELDS IN LBS. DUE TO MANURING IN THE WESTERN DISTRICT.

Hay Crops.

Number of Plot ..	1	2	3	4	5	6
Manure Applied ...	Complete Manure containing Nitrogen, Phosphoric Acid, and Potash.			Manures containing Two Ingredients Only.		
	Light Dressing.	Medium Dressing.	Heavy Dressing	Phosphoric Acid & Potash. No Nitrogen.	Nitrogen and Potash. No Phosphoric Acid	Phosphoric Acid & Nitrogen. No Potash.
Mr. Edwards, Hamilton ..	2,060	5,140	6,460	3,100	1,320	5,500
,, R. Pitman, Hamilton	1,980	2,340	1,360	1,720	1,660	2,140
,, Greenham, Dartmoor	1,568	2,688	2,800	1,344	420	2,436
,, Bremer, Allansford ..	2,680	4,360	5,500	3,800	1,160	820
Average of 4 fields ..	2,072	3,632	4,030	2,491	1,140	2,711
	Grain Crop in Bushels.					
Mr. Edwards, Hamilton ..	11·0	18·67	22·34	12·67	6·17	19·17
	Rape Crop in Pounds.					
Mr. Greenham, Dartmoor	40,680	46,620	51,580	54,540	8,374	53,547
	A Soil showing little or no response to Phosphoric Acid.					
Mr. John Glasgow, Wangoon.						
Weight of Wheat Sheaves in pounds ..	1,300	1,500	1,800	600	1,900	1,200
Grain in bushels ..	6·66	8·50	8·34	3·0	5·33	4·67

The increased yields reach, in most cases, very high figures. In the plot with the medium dressing complete manure, there has been a gain, taking an average of four fields, of 3,632 lbs. of hay, while the heavy dressing has resulted in an increase of 4,030 lbs. That phosphoric acid is the dominant deficiency, as far as the requirements of the hay crop are concerned, of the soils experimented on is evident in the returns of plot 5, where phosphoric acid has been omitted in the manure given. This has resulted in a loss of over 22 cwt. of hay per acre. That nitrogen and potash are also required to a less degree, is shown in the falling off in yields on plots 4 and 6. In the first case there has been a falling off of, approximately, 10 cwt., in the second of 8 cwt. to the acre. Very much the same results come out in the grain crop of Mr. Edwards, of Hamilton. The manures used in these experiments were heavy, but the results show splendid profits. On the plot with the medium dressing we find an increase of 18·67 bushels, while with the heavy application there is a gain of 22·34 bushels. The omission of phosphoric acid in plot 5 has resulted in a loss of 12½ bushels, while the loss owing to the absence of nitrogen is 6 bushels.

Manuring of Rape.

In the manuring of rape, however, in one of the same districts, the interesting fact seems to come out that the requirements of this crop may differ a little from those of a hay crop. The rape was grown on the farm of Mr. Greenham, who also grew a crop of hay. In the case of the hay crop the results distinctly show a dominant deficiency in phosphoric acid, a marked want in nitrogen, and a slight response only to potash. In the case of the rape, however, phosphoric acid appears, perhaps to be the only manurial requirement of the soil requiring serious consideration. The increased yields in this crop are very fine, amounting to over 24 tons.

A Soil That Does Not Respond to Phosphoric Acid.

There are of course soils in Victoria so fertile that they show little or no response to the application of manures, but these are in a small minority only. The great fertility of some of the soils of Warrnambool is well known. Attention might, therefore, be called to the case of Mr. Glasgow, of Wangoon, where phosphoric acid has apparently had little effect; but where nitrogen appears to be the dominant want. The weight of sheaves without phosphoric acid is considerably above that where it has been applied, while the application of phosphoric acid only has in one case resulted in a loss, and in the other an apparent gain so trifling that it requires no consideration.

Summary—Central, Southern, and Western Districts.

To generalise then on the soil requirements of the Southern, Central, and Western districts is not the easy matter that it is with the

Northern areas. The smaller number of results to hand, and the various other reasons I have already called attention to, prevent one speaking with too much confidence, but a few striking facts stand out in the results before you; that is, that all these soils respond to phosphoric acid, and that a combination of a complete manure gives better results than phosphoric acid alone; that nitrogen is required in a much less degree, and potash to a still less extent. There will be soils where the various requirements might be in the reverse order, but the fact I state might, I think, be accepted as generally true. It will be the work of my branch to confirm this. I will again, however, direct your attention to the fact that by a judicious system of rotation the expense of nitrogen manuring might be largely, perhaps entirely, got rid of for many crops.

Manuring the Orchard.

From the consideration of soil requirements in different parts of our State, I might, I think bring before you a few results obtained in the manuring of special crops, and these facts may possibly direct attention to the large possible profits obtainable from the manuring of other* crops besides grain and hay. In my endeavours to illustrate the soil requirements of different parts of the State I have already called your attention to some very fine increases in potato and rape crops. A few words on our efforts in the orchard might not be out of place. The use of manures is rapidly extending in the orchards of Victoria and this use must be justified by appreciably increased returns, otherwise we should never find the movement extending among fruitgrowers as it is doing. If manures are so productive of good results in the orchard, it might be expected that the branch could offer results just as instructive as those in other crops. But experiments in fruit manuring require time and much trouble, and the extra trouble coming, as it does, in a busy season is very frequently never taken, the result is that weights are not recorded and returns not sent in. Our most interesting returns during the last two years are in the manuring of peach trees. At Mr. Haig's orchard, at Tatura, where a complete manure was used, manuring showed a profit of 64 cases to the acre. At Lancaster, in the orchard of the Gallagher Bros., particularly interesting and profitable results were obtained. There were 14 plots in this field of eight trees each. Five remained unmanured for check purposes, nine were manured. The average yield of the five unmanured plots was 5,247 lbs. or 131 cases. The average yield of the nine manured, 7,205 lbs. per acre, an average gain, due to manuring, of 1,958 lbs., or, approximately, of 49 cases per acre. But there were plots which showed, naturally, a very much higher gain than this. The returns show, in nearly every case, that where nitrogen was added to the manure a lower yield was obtained than where nitrogen was left out. The manure giving the best result was a mixture of 128 lbs. concentrated superphosphate and 256 lbs. potash cholride. The yield on this plot was 252 cases per acre, the

* Some of these have been mentioned in my Annual Report.

yield on the adjoining unmanured plot was only 124 cases or slightly under the half of the manured plot. That the yield on this unmanured plot was much the same as the yields from the other unmanured plots will be seen by comparing it with the average yield of all the unmanured plots. This as we found was 131 cases. As it is probable I shall give a paper next September on the results of fruit manure experiments before the Victorian Fruitgrowers' Association, this mere reference to the matter will suffice for the present.

The Manuring of Hops.

An industry in which every effort is required to raise it from a languishing to a successful state is that of hop growing. It is probable that both increased yield and improved quality might follow the use of manures in our hop gardens. If the returns from one experiment can be relied upon as offering a basis for the expressions of opinion, then it seems certain that the application of suitable manures to the hop crop would prove a highly profitable operation.

There were some striking increases in yield obtained from experimental plots in the Bairnsdale district. There were 18 plots in the field, six unmanured and 12 manured. The average yield on the six unmanured plots was 440 bushels per acre. The average yield of the 12 manured plots was 516 bushels, an increase of 76 bushels. On two of the plots, however, treated with a complete manure, there were increased yields of 180 bushels. The dressing giving the most profitable returns appears to be:

3 cwt. sulphate of ammonia per acre.
$4\frac{1}{6}$ cwt. bonedust.
1 cwt. potash chloride.

At late market prices of 9d. per lb. for the dried hops, this would give approximately 1s. per bushel. The value of the increased yields of 180 bushels would be £9, which, taking into consideration all extra labor involved ought to result in a handsome profit.

Experiments in Beet Growing.

There is one crop I wish to call your attention to before closing. This is the beet, a crop, in my opinion, still full of large possibilities. Over 50 fields were put down in Victoria last year, most of them manured. The greatest number was in the Maffra district. The average yield and value of 29 crops based on determinations made between February 18th and April the 8th was 8·46 tons and £7 13s. 5d. Had the estimate been made up to the end of March only the value would have been higher, as the heavy Easter rains soon showed their effect on sugar percentage. We had then a harvesting period of a high sugar percentage of say 6 weeks. A week or fortnight after this a crop left in the ground would have been reduced very considerably in value. Determinations of the sugar percentage were afterwards made periodically. Between the 8th of April and the

3rd of May the average of 22 crops showed a yield of 11·44 tons of roots and a money value of £7 6s. 6d. per acre. The crop had increased in weight by 2·11 tons but had fallen in the sugar percentage. The average value of these 22 fields at the first test was £8 8s. 10d. so that the average value of the crop had been reduced by £1 2s. 4d. per acre. Another set of tests were made between the 3rd of May and the 7th of June. The average value of the 22 fields in this test was £8 3s. 3d. and the average yield 12·16 tons. The interesting fact comes out that besides showing an increase in weight the sugar percentage had risen so that the crop had nearly come back to its original value. If farmers can be induced to keep the crops in the ground, which is doubtful, tests will be made from time to time up to the beginning of spring to determine the increased value, if any, in the crop. Information on this point might have important bearings. Very fine returns were obtained in the Traralgon, Glengarry, Cowwarr and Flynn's Creek districts. An average of 13 fields from these districts gave a yield of 17·29 tons per acre of a sugar content of 16·87 per cent. and a money value of £15 17s. 8d.

In the Geelong district the returns, owing to unfavorable climatic conditions, were hardly so good as in the Maffra district. There are gentlemen, I believe, present to-day from the Western district and I would strongly advocate their co-operating with the department in carrying out experiments in the growth of this crop.

Manuring Experiments on Waste Lands.

Leaving now the soils under cultivation, and the treatment required for the crops they grow, I can introduce to your notice the attempts that have just been commenced at proving whether the so-called waste lands of the State might not be put to some useful purpose.

There are immense areas in Victoria considered of little or no agricultural value, and regarded as waste lands. There are reasons for believing that such lands by manuring and, in cases, other treatment might be profitably utilized. The Chemical Branch has made a beginning in investigating the possibilities in this direction in two cases. One in the large stretch of sandy country at Dimboola, known as the Little Desert, and the other in what is known as the Heath Country, at Foster. In the latter case the ground has been broken up and roughly drained, ready for sowing in the spring. Scarcity of labor and other reasons prevented the owner having this done last year as intended. In the Little Desert some 40 grasses and fodder plants were tried besides fruit trees. The field officer on inspecting reported that lucerne, Bokhara clover, Johnson grass, Hungarian fodder grass, and prairie grass had made very fair growth. Saltbush, Natal red top grass and New Zealand spinach appeared to have succeeded particularly well, and this after practically eight months' drought. The accompanying photographs will give some indication of this.


Saltbush
Natal Red Top grass
New Zealand Spinach.

The original purpose of putting in the New Zealand spinach was to test it as a soil binder, and as a rank growth for green manuring. It serves both purposes admirably. There was not sufficient to test it for stock purposes, but appearances indicate that it might be valuable for this purpose also. The photographs, which are little more than half life size, will give some indication of the growth of the three plants. The Natal red top was a particularly fine grass, well adapted, apparently, for hay. The growth of the saltbush has particularly pleased the local residents, who see in its successful cultivation the possibility of converting the desert into a good grazing area.

The analyses I have had made of the soils from the Little Desert and Foster will show that they are exceedingly poor. In the case of the Little Desert it is little better than a pure sand. But, providing the moisture conditions are favorable, it is astonishing what might be done by suitable treatment on our poorer soils. As an instance, let me call your attention to the analysis of a soil from Swan Reach. This is from the farm of Mr. Whelan, and is representative of a soil little better than the two alluded to. This soil is, I believe, also typical of a very large area in Gippsland considered as of little or no value. The native growth is stringy bark, with a thick undergrowth of bracken fern. The same class of country, I am told, extends from the Lakes to Buchan, and from the Tambo to the Snowy River, being some 30 miles square and reserved at present as a State forest.

Analyses of Soils at Foster, Little Desert, and Swan Reach.

	Nitrogen	Phosphoric Acid.	Potash	Lime.	Chlorine.	
Foster ..	120	20	48	19	93	Parts in 100,000
Little Desert	48	5	8	30	2	do.
Swan Reach	143	38	47	284	6	do.

An experimental field in maize was put down on this farm in 1900 with the following results :—That on one of the plots a yield of 55·8 bushels was obtained. On another plot, manured with ⅔rd cwt. concentrated superphosphate and ⅔rd cwt. potash chloride, a yield of 48·3 bushels was harvested. The increases due to manures were heavy and profitable, in face of what might be considered the heavy expenditure incurred in manuring. But the profits on the maize were by no means the only profits, for a mixed oat and wheat crop afterwards sown for hay on the plots without further manuring, showed, in instances, increases amounting to 20 and 24 cwt. to the acre from the manure still left in the ground. With manures splendid potato and onion crops have been grown on this soil. The potato crop, I am informed, reached 12 tons to the acre, calculated from a small plot, the onion crop above this, and this on soil representative of an enormous area and considered to-day as of little or no agricultural value. Truly, gentlemen, without hyperbole such results have indeed shown us how to add another province to Victoria.

Conclusion.

My paper has taken up more of your time than I had thought it would; but, even so, I have only given you the skeleton outlines of what the Chemical Branch has attempted within the last two years. The importance of the facts I have brought before you, has not, I feel sure, escaped you. Their full significance will, perhaps, only gradually work itself into your minds. Your welfare and the prosperity of the country generally are bound up with such investigations; and, wherever else the pruning knife may be applied, on the score of necessary economies, I hope that you, as a body, will resist tooth and nail all attempts to cripple any branch of our Agricultural Service, and that you will insist that the great movement that has been made for the solution of your agricultural problems shall still continue a forward movement.

MISTLETOE IN OUR FORESTS.

By D. McAlpine.

Owing to representations made by the Waranga Shire Council regarding the damage caused by the spread of mistletoe in the State forests, the Director of Agriculture requested me to furnish a short report on the subject. That report has been substantially reproduced here, as considerable interest has been manifested in the matter.

Though it is not an easy matter to get rid of the mistletoe once it has gained a footing on our forest trees, a knowledge of its nature and history gives a clue to the methods necessary in order to cope with it.

Like any other flowering plant, the mistletoe grows from a seed, and these seeds are carried about from tree to tree by birds. So well recognised is this, that one Australian bird is generally believed to be the exclusive agent in the dispersal of the mistletoe, and it is called, on this account the Mistletoe-bird. This pretty little swallow, *Dicæum*, is also called the Flower-pecker, and none are found in Tasmania, probably because no mistletoes grow there. Some observers assert that other birds, especially the Honey-eaters, also serve to distribute the seed. It is not necessary to explain how the bird extracts the seed, with its sticky covering, from the berry, but, as this seed-covering is very sweet, it is relished by the birds just as it is by schoolboys. The seeds then pass through the alimentary canal of the bird, and are deposited on some twig or branch, under the most favorable conditions of heat, moisture and manure for successful germination. They may also germinate without passing through the body of the bird, as, for instance, when the bird cleans its beak it may deposit the seed. The slightest crack in the bark will allow the young roots to penetrate, and then the mistletoe sucks the sap of the branch on which it is parasitic.

Of course if we could get rid of the seed-carriers, the birds, that would largely reduce the mischief; but, I presume it is not expedient to shoot the birds.

The only practicable way to get rid of it would be, as they do in orchards, to have the infested branches entirely removed, before the mistletoe has had time to spread to any great extent. To break off the plants themselves is worse than useless, for it only induces the part that is left to send out vigorous roots, and get a firmer hold of the tree. In Germany, and other countries, official notice is annually given for the extermination of the mistletoe, and this work of removing the infested branches could be undertaken at the same time as the thinning-out was being done.

GENERAL NOTES.

Swine Fever.

The organism which is now generally accepted as the cause of this disease is a small actively motile, non-sporulating bacillus, with rounded ends, discovered by McFadyean. It grows slowly at summer temperature, and possesses very feeble powers of resistance.

All cases of swine fever are probably caused by the animals feeding on material soiled with the fæces of a previous subject of the disease. It is to be feared, though, that even yet the lay officials of the Board of Agriculture do not recognise the purely contagious nature of the disease. It is possible that the organisms may, in rare instances, be carried by the boots and clothes of human beings; but the chief source of infection is the pig, which, although not showing any clinical symptoms, is affected by the disease in a mild degree, or in which the disease is in an incubative stage. It must be remembered that in many cases of swine fever the symptoms are so slight as altogether to escape detection, and the only safe basis for an opinion in those cases is a post-mortem examination.

With regard to preventive measures, remembering the frequency with which apparently healthy pigs are found to be affected, and that these are by far the most frequent means of spreading the disease, irksome as they may be, the imposition of very strict restrictions on the movements over large areas, and thorough disinfection of infected premises, must be rigidly adhered to.—*Transactions of the Highland and Agricultural Society of Scotland, 1903.*

Poisoning Sparrows.

A simple and efficient method of poisoning sparrows would be particularly welcome in some districts, and those plagued by these pests may find worthy of trial the following method vouched for by Mr. Aston, the Chemist to the Agricultural Department of New Zealand:—Thoroughly damp ten pounds of good sound wheat with fresh milk, so that the whole grain is wet but not dripping with moisture; five-sixths of an ounce (avoirdupois) of powdered strychnine is then gradually shaken on to the grain, the whole being constantly stirred. When all the strychnine is mixed the grain should be immediately laid. The best way is to spread a good train of chaff, free of grain, which will serve to attract attention, and then the poisoned grain may be lightly sprinkled on the chaff. The most suitable places for laying the poison are on roadways, near trees or hedges. To secure good results it is necessary to spread the grain thinly, and as soon after mixing as possible. It would probably be advantageous to select different spots each day for laying the poisoned grain, since the dead birds would not then scare away those still living.

There are some, however, who object to the use of strychnine for poisoning sparrows on account of its rapid action. The sparrows thus poisoned die on the spot, and the others readily take the hint and do not come near again. One who has destroyed them wholesale when attacking the crops recommends the use of phosphorised wheat, oats, or barley. A portion of the land is rolled flat on which the poisoned grain is laid, and the sparrows eating it fly away and die at a distance, so that their fellows do not see any evidence of the poisonous nature of the food provided for them.

Cape Fruit in London.

Very considerable quantities of grapes have been despatched to London from the Cape during the past season, and have generally carried well. The bunches are packed in single layers in shallow cases, about six inches in depth, fine wood shavings being used in place of cork dust, as the fruit keeps cleaner and looks better when unpacked.

The varieties are chiefly Hanepoot, Raisin Blanc, and a kind of Muscat—all white grapes. Some red varieties are exported also, and generally realise more than the white ones. The temperature at which they are carried ranges from 36 to 40 degrees, and frequently on arrival the bloom is found still upon the berries. The cases are made of white pine, and are sent separately, not cleated together, though half-inch battens are nailed on each to provide for air circulation. The capacity of the cases is about 18 lbs., and they realise from 10s. to 13s. each.

Pears are also sent, packed with wood shavings in single layers in shallow cases, and are carried at the same temperature as grapes. Williams' Bon Chrêtien are realising from 9s .to 12s. per dozen fruits. Peaches, principally a good clingstone variety, are selling at the same price. Kelsey plums carry well in the shallow cases, containing about 24 fruits each, and bring 5s. 6d. to 8s. per case. By the time these fruits arrive in London they may be said to have been packed for three weeks, the voyage itself occupying eighteen days.

Fruit Transportation in America.

In the ordinary method of fruit transportation in the United States for long distances, at the present time, refrigerator cars are used exclusively. The Continental Fruit Express Company are owners of the larger proportion of cars used in the fruit trade from California to points beyond the Mississipi, the Armour Company also being large proprietors. These cars have compartments for ice in each corner, capable of holding altogether about 6 tons of ice. The cars it may be stated are very large, generally 36 feet in length. The ice is placed into the boxes from the top of the car. Railroad agents at certain points on the journey of 2,000 to 3,000 miles, according to destination, examine the ice chest and replenish the ice when necessary. Immense quantities of natural ice are collected in the Sierra Nevada and Rocky

Mountains in the spring, and stored in great storehouses built for this purpose. The temperature of the cars is kept at about 40 degrees during transit. Peaches, apricots, pears, cherries, plums, oranges and grapes are carried in this way from California to the Eastern States during the hot months. An additional charge on freight rates is made for refrigeration of fruit during transit. These refrigerator rates from California to New York, Baltimore, Philadelphia and Rochester collected by the Continental Fruit Car Express Company are as follows :—

	s.	d.
Cherries, per 11 lb. box	0	11
Peaches ,, 21½ lb. ,, ...	1	9½
Apricots ,, 25 lb. ,, ...	2	1
Nectarines, per 25 lb. box	2	1
Plums, per 26 lb. box	2	2
Prunes ,, 26 lb. ,, ...	2	2
Pears ,, 50 lb. ,, 6 lbs. tare	4	0
Apples ,, 50 lb ,, 8 lbs. ,, ...	4	0
Grapes, single crates, per 25 lbs.	2	1
,, ,, ,, ,, 56 lbs.	4	6

The through freight from California to London on pears, peaches, apricots and plums is 6s. 6d. per case; half cases, 3s. 3d. On apples, 5s. 1d.

The freght rates on barrels of apples, 120 lbs., from Canada and the States to the United Kingdom vary somewhat, and are as follows :—

	s.	d.		s.	d.
From Halifax to London	3	0	to	3	6
Montreal to London				3	6
New York by American line *via* Southampton .. .				3	6
New York to London (direct boats)				2	6
,, ,, Liverpool ,, ,,				2	6
Boston to London				3	0
,, ,, Liverpool	2	0	to	2	6

To Destroy Red Spider.

Two methods are given in a recent Bulletin of the California Agricultural Experiment Station as effective against the red spider. The first is suited only for warm districts, and for employment in sunny weather, and consists in dusting the trees with dry powdered sulphur in just the same way as vines are sulphured for oidium.

A good spray for the same purpose suited to any climatic conditions is the sulphide of potash mixture, made as under :—

STOCK SOLUTION.

Potash	32 lbs.
Sulphur, finely powdered	37 lbs.
Salt	2 lbs.
Water	50 gals.

FOR USE.

One part of stock to about 100 gals. of water.

The potash, sulphur and salt are to be mixed together in a large *metal* tub with a little water, chemical action will at once set in, and the whole mass will dissolve and begin to boil very vigorously. After

the boiling has ceased the remainder of the water is added. It is considered doubtful whether the salt is of any use in the mixture, but it can, at least, do no harm in such small quantity. Though effective enough against the red spider in the active stages of its growth, this mixture is stated to be of little value as a general insecticide, at least, at the strength advised. Three applications, at intervals of a week, are necessary to effect a complete clearance of the pest.

It is stated by the author of the Bulletin that "*Fumigation with hydrocyanic acid gas is of no value whatever as a means of controlling the red spider.*"

Oil of Turpentine for the Bot Fly.

Considerable prominence has been given in the press to a statement made by Mr. Schulz, at Murtoa, that he had administered a drench, recommended by the Chief Inspector of Stock, to two horses attacked by the bot fly, and that the death of the animals, which took place shortly after, was due to the injurious influence of the oil of turpentine. The drench recommended in the *Journal of Agriculture*, July, 1902, was as follows :—

Raw Linseed Oil	1 pint.
Oil of Turpentine	2 ozs.

This quantity was stated to be sufficient for an ordinary hack.

In a memorandum addressed to the Director of Agriculture, the Chief Inspector of Stock states "that Mr. Schulz must have made some mistake, as the drench would produce no such result if properly administered, and has been given thousands of times to horses without injury. Mr Schulz is said to ascribe the cause of death to giving the horses 2 ounces each of oil of turpentine. Authorities of such repute as Youatt (revised by Spooner), Tuson (*Veterinary Pharmacopœia*), Finley Dunn (*Veterinary Medicines*, 1901 edition) recommend the administration of up to 3 fluid ounces for worms. The two ounces could not possibly have caused the deaths, that is, *if the medicines recommended had been given.* Boiled oil may have been administered instead of raw linseed oil, or crude spirits of turpentine instead of oil of turpentine."

Since the above was written the following letter has been received from Mr. August Uhe, Secretary of the Murtoa Farmers' Association :—

MURTOA, *June 23rd, 1903.*

THE EDITOR OF THE "JOURNAL OF AGRICULTURE.

DEAR SIR,—I am directed by the above Association to state the experience of one of its members, who tried, as an experiment, the prescription appearing in the *Journal of Agriculture*, July, 1902, for destroying bots in horses, by Mr. J. R. Weir, Chief Inspector of Stock.

The directions were carefully carried out, with the exception that 1¾ ozs. of spirits of turpentine was used in place of 2 ozs. of oil of turpentine as in the prescription. The experiment was tried on three horses, two young strong horses, draughts, and one aged one, with the result that the two younger horses died five days after treatment, and, on being opened, it was found that the coating was completely taken off the stomach. The aged animal recovered.

Mr. W. T. Kendall, M.R.C.V.S., who, it may be said, thoroughly endorses the treatment suggested, in commenting on this case, offers the following explanation :—

As to the cause of death in horses after dosing with oil and turpentine, it is not, as a rule, the turpentine that is to blame, but the linseed oil. Horses have a great aversion to this drench, and resist being drenched to the utmost, consequently the risk of some of the medicine getting into the windpipe is greatly increased, and unless the head is let down whenever the horse begins coughing, choking may take place, or some of the drench goes the wrong way, and death results from broncho-pneumonia. When the medicine gets into the lungs the turpentine is immediately absorbed, but the oil remains as a mechanical irritant and causes all the trouble. In proof of this two ounces of raw turpentine may be injected into the windpipe and no harm will be done, while the same dose of linseed oil, administered in the same manner, would most likely be fatal.

RAINFALL IN VICTORIA.

MONTHS OF APRIL AND MAY, 1903.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in April, 1903.	Average rainfall for each Area for the month of April based on all previous years of record.	Maximum fall recorded within each Area during April, 1903.	Actual Average rainfall recorded in each Area in May 1903.	Average rainfall for each area for the month of May, based on all previous years of record.	Maximum fall recorded within each area during May, 1903.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	2·25	1·32	2·84 at Berriwillock	1·15	1·32	1·71 at Rainbow
B	2·81	1·95	3·66 ,, Serviceton	1·78	1·93	2·16 ,, Warracknabeal
C	3·96	2·31	4·73 ,, Panmure	2·36	2·62	3·47 ,, Panmure
D	4·25	2·89	6·21 ,, Cape Otway	3·07	3·20	3·89 ,, Port Campbell
E	2·38	1·72	2·99 ,, Kaneira	0·66	1·77	0·98 ,, Charlton
F	2·78	2·11	5·28 ,, Benalla	0·58	2·55	1·07 ,, Chiltern
F^1	3·61	2·13	4·10 ,, Euroa	0·67	2·93	0·93 ,, Alexandra
F_2	3·41	2·53	3·59 ,, Tallangatta	1·02	3·69	1·47 ,, Yackandandah
G	3·18	2·17	4·20 ,, Maryborough	1·18	2·55	1·93 ,, St. Arnaud
H	3·86	2·72	4·69 ,, Daylesford	1·68	3·17	1·98 ,, Ballarat
I	3·30	2·49	4·39 ,, Ballan	1·21	2·29	1·94 ,, Melbourne
I^1	4·24	2·99	5·00 ,, Lilydale	2·75	3·16	3·17 ,, Cape Schanck
K	4·09	3·43	7·49 ,, Warburton	2·39	3·91	4·74 ,, Warburton
L	2·00	2·85	4·06 ,, Bruthen	1·15	2·06	1·83 ,, Alberton
M	—	3·35	2·12 ,, Gabo	—	4·14	5·36 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

ARRIVALS IN MELBOURNE OF BUTTER, and Butter Ex Cream in Tons net, by Rail and Steamer from the different Districts of Victoria for the first five months of the years, 1903 and 1902 respectively.

Months.	Totals.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
January ..	1,792	1,621	306	257	56	106	836½	765	593½	493
February ..	1,373½	1,169½	90½	196	47½	50	814	630	421½	293½
March.. ...	1,370	977½	112	92	27	25	740½	650	490½	210½
April	910½	597½	140	60	14½	16	443	359	313	162½
May	444	567	92	55	9	13	204	421	139	78
Totals ..	5,890	4,932½	740½	660	154	210	3,038	2,825	1,957½	1,237½

EXPORTS OF PERISHABLE AND FROZEN PRODUCTS for the Months of April and May, 1903 and 1902 respectively.

Description of Produce.		1903	1902	*Increase. †Decrease.
Butter	lbs.	1,775,244	1,483,608	* 291,636
Milk and Cream	cases	1,434	333	* 1,101
Cheese..	lbs.	167,700	43,082	* 124,618
Ham and Bacon	,,	276,846	121,912	* 154,934
Rabbits and Hares	pairs	357,240	217,792	* 139,448
Poultry	head	26,100	37,425	† 11,325
Mutton and Lamb	carcases	12,291	10,425	* 1,866
Veal	,,	931	90	* 841
Beef	qrtrs.	1,022	14	* 1,008
Fruit	cases	53,538	22,389	* 31,149
Fruit Pulp	,,	1,554	—	* 1,554
Eggs	dozens	360	—	* 360
Pork	carcases	34	—	* 34

DELIVERIES OF PERISHABLE AND FROZEN PRODUCTS from the Government Cool Stores for the Months of April and May, 1903 and 1902 respectively.

Description of Produce.		1903	1902
Butter	lbs.	374,136	982,016
Milk and Cream (Concentrated)	cases	1,696	1,300
Eggs	doz.	44,690	46,953
Rabbits and Hares	pairs	197,343	162,908
Poultry	head	9,485	40,696
Mutton and Lamb	carcases	5,463	611
Veal	,,	359	29
Beef	qrtrs.	56	—
Fruit	cases	2,466	2,190

R. CROWE.

Fruit and Plants.

EXPORTS to Australian States and New Zealand only, Inspected during April and May.

Fruit.		Cases or Packages Inspected.		Certificates Given.	
		April.	May.	April.	May.
Apples	cases	15,412	5,297	188	106
Bananas ..	,,	1,713	2,320	242	242
Citrons	,,	2	—	2	—
Cucumbers ..	,,	1	—	1	—
Figs	,,	3	—	3	—
Grapes	,,	1,314	352	195	111
Lemons	,,	202	469	78	90
Melons	,,	18	13	9	11
Mixed Fruits ..	,,	2	2	2	2
Nectarines ..	,,	1	—	1	—
Oranges	,,	122	262	77	112
Passion Fruit ..	,,	51	61	26	33
Peaches	,,	116	2	46	1
Pears	,,	7,709	2,967	226	130
Persimmons ..	,,	—	7	—	6
Pineapples ..	,,	395	241	102	103
Plums	,,	5	2	2	1
Quinces	,,	4,106	956	95	69
Tomatoes ..	,,	31	—	6	—
Total Cases Fruit ..		31,203	12,951	1,301	1,017
Plants	pkgs.	122	200	60	106
Totals		31,325	13,151	1,361	1,123

EXPORTS of Fruit beyond Australia and New Zealand from January 1st to May 30th, all having been Inspected.

	Apples.	Pears.	Grapes.	Lemons.	Totals.
United Kingdom	57,401	3,685	201	—	61,287
South Africa	14,786	52	—	—	14,838
Germany	4,999	201	—	—	5,200
Italy	225	—	—	—	225
Belgium	182	5	—	—	187
Java	3,037	337	—	20	3,394
India	1,465	—	—	—	1,465
China	2	—	—	—	2
Malay Peninsula	200	—	—	—	200
Totals	82,297	4,280	201	20	86,798

J. G. TURNER,
For C. FRENCH.

Farm Produce.

EXPORTS Certified to during April and May, 1903.

Shipped to.	Produce.	Number.	Approximate Quantity.
South Africa	Potatoes	675 cases	23 tons
		875 bags	73 ,,
	Onions	3,315 cases	135 ,,
		3,413 bags	224 ,,
	Compressed Fodder	9,189 bales	325 ,,
Manila	Onions	4,600 case	150 ,,
Germany	Potatoes	75 cases	5 ,,
New South Wales	Potatoes	647 bags	53 tons
	Onions	12,033 ,,	794 ,,
	Oats	390 ,,	1,560 bushels
	Chaff	813 ,,	30 tons
Queensland	Potatoes	4,339 bags	352 tons
	Onions	4,430 ,,	290 ,,
	Wheat	10 ,,	1 ,,
	Oats	7 ,,	10 cwt.
West Australia	Potatoes	3,958 bags	330 tons
	Onions	872 ,,	57 ,,
South Australia	Potatoes	359 bags	30 tons

J. KNIGHT.

DAIRYING

Laboratory Courses for Butter and Cheese Factory Managers, Vignerons, and others.

Courses of Laboratory work in applied Bacteriology lasting a fortnight each have been arranged as follows :—

TRARALGON, August 3rd.

KORRUMBURRA, August 17th.

MOOROOPNA, September 7th.

The Classes will be held at hours to suit the convenience of the majority of the students. No fees are charged for the course and microscopes and all necessary apparatus are provided by the Department. Those wishing to join are requested to communicate with the Secretary of the local factory, or with Dr. Cherry as soon as possible.

Agricultural Societies and other Bodies wishing to have evening lectures on the Dairying Industry are requested to make early application, so that the lectures near each of the above centres may be arranged while Dr. Cherry is conducting each of the above classes. The following lectures have been arranged :—

July 2—NHILL.
,, 3—WALMER ESTATE.
,, 7—WHITFIELD.
,, 9—BRUNSWICK.
,, 16—MELBOURNE.
,, 23—BOORT.
,, 30—WODONGA.
,, 31—BENALLA.

PUBLICATIONS ISSUED BY THE DEPARTMENT.

Bulletins.

Reprinted from the Journal.

No. 1. Impressions of Victoria from an Agricultural Point of View. By S. Williamson Wallace.
No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
No. 3. Black Spot of the Apple, together with Spraying for Fungus Diseases. By D. McAlpine.
No. 4. Review of the Past Butter Season. By R. Crowe.
No. 5. Two Years' Field Work of the Chemical Branch. By F. J. Howell, Ph. D.
No. 6. Co-operative Forage Experiments in Southern Victoria. By F. J. Howell, Ph. D.

Guides to Growers.

No. 19. Lavender. By J. Knight.
No. 20. Broom Corn. By J. Knight.
No. 24. The Fig Industry. By C. B. Luffmann.
No. 25. Cultivation and Treatment of Tobacco. By A. J. Bondurant.
No. 26. Treatment of the Raisin Vine. By C. B. Luffmann.
No. 27. Insect Pests and Fungi. By C. French and D. McAlpine.
No. 28. Regulations under the *Vegetation Diseases Act* 1896.
No. 31. Wheat Experiments, 1896. By Hugh Pye.
No. 32. Fungus Diseases of the Raspberry By D. McAlpine.
No. 41. Cider-making. By J. Knight.
No. 46. Purifying Water for Butter-making and for Country Purposes Generally. By A. N. Pearson.
No. 47. Manures in the Victorian Market. By. A. N. Pearson.
No. 48. Codlin Moth Experiments. By C. French.

Revised List of Fruit Trees, &c., Recommended for Cultivation as Suitable for Marketing, Canning, Drying, Exporting, &c.
Modern Dairying. By D. Wilson and R. Crowe.
Report on the Preservation of Fruit for Shipment. By J. M. Sinclair.
Report on Meat Inspection in the United States. By J. M. Sinclair.
The Butter Industry of Victoria and the British Export Trade. By J. M. Sinclair.
Prospectus and Regulations of the Agricultural College and the School of Horticulture, with Syllabus of Instruction.
Report on Wheat Experiments at Port Fairy and in the Mallee. By D. McAlpine.
Poultry Breeding and Management for the English Markets.
Report on Successful Farming in the Mallee. By F. J. Howell, Ph. D.
List of Butter and Cheese Factories in the State of Victoria.
Manures and Manuring. By A. N. Pearson.
Influence of the Elementary Plant Foods on Plant Growth. By A. N. Pearson.
The New Agriculture. By the Hon. I. A. Isaacs.

List of Exporters of Agricultural Products.
The Scientific Directing of a Country's Agriculture. By A. N. Pearson.
Report by Hugh Pye, Principal, Agricultural College, Dookie, on the Experimental Work of the College for 1899-1900.
Silos and Ensilage. By J. L. Thompson.
Additions to the Fungi on the Vine in Australia. By D. McAlpine.
Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
Chart for the Guidance of Dairymen. By R. Crowe, Dairy Expert.
Directions for Preparing Starters. By H. W. Potts, F.C.S.
Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
Report on Field Experiments in Victoria, 1887-1900, Section Manuring. By A. N. Pearson.

Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
Report of Conference on the Elevator System in the Handling and Shipment of Grain.
Annual Reports, 1899, 1900 and 1901.
Report on the Hog-Raising and Pork-Packing Industry in the United States, and on the Live Stock and Frozen Meat Exportation of the Argentine Republic. By J. M. Sinclair.

Any of the above may be had Free, on application to the Secretary for Agriculture.

Destructive Insects of Victoria, Parts I., II., III. By C. French. Price 2s. 6d. each.
Fungus Diseases of Citrus Trees in Australia. By D. McAlpine. Price 2s.
Fungus Diseases of Stone Fruit Trees in Australia. By D. McAlpine. 165 pp., 10 colored plates. Price 2s. 6d.
Fungi of Australia. By Dr. Cooke. Price £1 1s.

WORKS ON VITICULTURE. TRANSLATED FROM THE FRENCH BY R. DUBOIS AND W. PERCY WILKINSON.

Wine-making in Hot Climates. By L. Roos. 273 pp., 61 illustrations, 5 plates. 1900. Cloth-bound, 2s.
First Steps in Ampelography. By Marcel Mazade. 95 pp., 43 illustrations. 1900. Cloth-bound, 1s.
Trenching and Sub-soiling for American Vines. 171 pp., 110 illustrations, 10 plates. 1901. Cloth-bound, 2s.
New Methods of Grafting and Budding as applied to Reconstitution with American Vines. 72 pp., 89 illustrations. 1901. Cloth-bound, 1s.
American Vines: Their Adaptation, Culture, Grafting, and Propagation. By P. Viala and L. Ravaz. 297 pp., 150 illustrations, 10 colored plates. 1901. Cloth-bound, 3s. 6d.
Studies on Wine-sterilizing Machines. By U. Gayon. 103 pp., 45 illustrations, 2 colored plates. Cloth-bound, 2s.

PROSPECTUS

OF THE

School of Horticulture.

The school is designed for the teaching and training of orchardists gardeners and managers of fruit-growing properties. It is situated in a near suburb of Melbourne, and has a good tram and train service.

The estate comprises upwards of 40 acres of varied land, of which twenty are at present devoted to fruit trees, vegetable culture, a nursery and flower gardens.

New stables, plant houses, frames, sheds and other buildings have recently been erected. Class, dressing, luncheon and work rooms form portion of a large pavilion, wherein shelter and occupation are found in adverse weather.

Class-room instruction is given in horticultural science vegetable pathology, botany, chemistry of soils and plants, physical and commercial geography, entomology, measuring, levelling, designing, and plotting of homesteads, orchards and garden areas, and the most approved methods of raising and managing fruit trees and plants. Practical work includes the propagation and management of orchard trees, citrus, table grapes, bush fruits; harvesting, storing, packing, marketing, drying and canning of fruit, vegetable culture, clearing, grading and trenching of land, management of soils, manures, drainage and villa gardening.

Application for admission should be made to the Secretary for Agriculture, Public Offices, Melbourne, from whom further information may be obtained.

LIST OF AGRICULTURAL, HORTICULTURAL AND VINE AND FRUIT GROWERS' SOCIETIES AND THEIR SHOWS.

Agricultural Societies.

Society.	Secretary.	Address.	Date.
			1903
Balmoral P. and A. Society ..	Alex. Sutherland ..	Balmoral ..	August 12th and 13th
The Royal Agricultural Society of Victoria	Thomas Patterson	Equitable Bldg., Collins-st., City	Sept. 2nd, 3rd, 4th, 5th
Coleraine P. and A. Society ..	J. F. Friend ..	Coleraine ..	„ 9th
Casterton P and A. Society ..	Herbert N. Jacobs	Casterton ..	„ 10th
Geelong and Western District A. and H. Society	H. D'Helin ..	Ryrie-st., Geelong	„ 9th and 10th (Grand National)
Horsham and Wimmera District A. and P. Society	Leslie Smith ..	Horsham ..	Sept. 11th
Stawell and Wimmera District P. and A. Society	J. A. Larkan ..	Stawell	„ 15th and 16th
Ovens and Murray A. and P. Society	Wm. Harrison ..	Wangaratta ..	„ 16th and 17th
Rupanyup and Dunmunkle District A. and P. Society	J. J. Gibson ..	Rupanyup ..	„ 18th
Ararat Ag Society	T. Gibson ..	Ararat	„ 23rd
Kerang District Ag. Society ..	John Coleman ..	Kerang	„ 23rd
Boort Ag. Society	Wm. H. Odgers ..	Boort	„ 30th
Elmore District A. and P. Society	E. Robert Warren	Elmore	„ 30th
Lancefield Farm & Garden Society	C. R. Olney ..	Lancefield ..	September
Hopetoun A. and P. Society ..	Herbert E. Ackland	*Courier* Office, Hopetoun ..	October 2nd
Benalla A. and P. Society ..	R. J. Blackburne .	Benalla	„ 6th and 7th
St. Arnaud P. A. and H. Society ..	Geo. H. Osborne ..	St. Arnaud ..	„ 7th
Murtoa and Central Wimmera A. and P. Society	Edward S. Lee ..	Murtoa	„ 7th
Bendigo A. and H. Society ..	H. M. Marks ..	Central Auction Rooms, Bendigo	„ 13th, 14th, 15th
Nhill A. and P. Society	C. H. Towns ..	Nhill	„ 14th
Numurkah A. and P. Association ..	W. A. Fairless ..	Numurkah ..	„ 14th
Euroa A and P. Society	E. Gallagher ..	Euroa	„ 14th
Tatura and Goulburn Valley A. H. and P. Association	Luke Flanagan ..	Tatura	„ 20th and 21st
Maryborough Ag. Society ..	T. C. Miners ..	Maryborough ..	„ 21st
Maffra Ag. Society	W. T. Clarke ..	Tinamba ..	„ 22nd
Shepparton Ag. Society	J. E. Byass ..	Shepparton ..	„ 27th and 28th
Bairnsdale District P., A., and H. Society	L. S. Moody ..	Bairnsdale ..	„ 29th
Bacchus Marsh A. and P. Society ..	F Howe	Bacchus Marsh ..	„ 29th
Kilmore Ag. Society	J. Osborn ..	Kilmore ..	Nov. 4th
Clunes, Coghill's Creek, Beechworth, and Eglinton Ag. Society	F. J. Miles ..	Fraser-st., Clunes	„ 6th
Heathcote A., P., and A. Society ..	H. Bradshaw ..	Heathcote ..	„ 11th
Smeaton, Spring Hill, and Bullarook Ag. Society	John T. Yates ..	Newlyn Railway Station	„ 12th and 13th
Ballarat A. and P. Society ..	J. J Kelsall ..	Lydiard-street N., Ballarat	„ 18th, 19th, 20th
Kyneton Ag. Society	W. A. Hoyle ..	Kyneton ..	„ 18th
Condah P. and A. Society	Henry Baker ..	Condah ..	„ 25th
Ballan Ag. Society	J Muntz	Shire Hall, Ballan	„ 26th
Colac and District A. and P. Society	P. W. Fallon ..	Colac	„ 26th
Mansfield A. and P. Society ..	H. J. Lewis ..	Mansfield ..	„ 26th
Hampden and Heytesbury P. and A. Society	J. R. Hindhaugh ..	Manifold-street, Camberdown	December 3rd
Dandenong and South Bourke A. and H. Society	J. J Ahern ..	Dandenong ..	December
			1904
Frankston H. and A. Association ..	J. N. Marsh ..	Langwarrin ..	January 21st
Tallangatta A. and P. Society ..	Thos. Anderson ..	Tallangatta ..	March
Bunyip Ag. Society	Chas. Pearson ..	Bunyip	April 1st
Alexandra Ag. Society	—	Alexandra ..	
Baringhup and Maldon Ag. Society	Jas. McLay ..	Joyce's Creek ..	
Beaufort Ag. Society	—	Beaufort ..	
Beulah Ag. Society	—	Beulah	
Birchip District Ag. Society ..	W. J. Stevens ..	Birchip	
Buln Buln Ag. Society	Wm. Hy. Morton ..	Buln Buln ..	
Charlton Ag. Society	—	Charlton ..	
Chiltern Ag. Society	—	Chiltern ..	
Cobram A. and P. Association ..	A. E. Ross ..	Cobram ..	
Congupna Farmers' Club	—	Congupna ..	

AGRICULTURAL SOCIETIES—*continued.*

Society.	Secretary.	Address.	Date.
Cororooke Farmers' & Dairymen's Association	J. Beal	Cororooke ..	
Corryong and Upper Murray A. and P. Society	A. W. Acocks ..	Corryong ..	
Deakin Shire Progress Association	—	Tongala ..	
Devenish A. and P. Society ..	P. L. M'Callum ..	Devenish ..	
Dimboola and North Wimmera Ag. Society	—	Dimboola ..	
Donald District Ag. Society ..	—	Donald ..	
Dookie A. and P. Society	M. J. Ryan ..	Dookie	
Drik Drik Ag. Society	R. A. Lightbody ..	Drik Drik ..	
Drouin Ag. Society	—	Drouin	
Dunolly Ag. Society	R. Clay	Dunolly ..	
Echuca A. and P. Society ..	A. F. D. White ..	Echuca	
Geelong District Farmers' Club ..	—	Geelong ..	
Gippsland North Ag. Society ..	—	Sale	
Gippsland South Ag. Society ..	—	Yarram ..	
Glenlyon, Franklin, and Daylesford Ag. Society	T. H. Avison ..	Daylesford ..	
Goroke and South Lowan Ag. Soc.	—	Goroke	
Grantville and Jeetho A., P., and H. Society	A. Belfrage ...	Bass Valley, *viâ* Loch	
Hamilton Ag. Society	—	Hamilton ..	
Hardie's Hill, &c., Ag. Society ..	—	Mount Mercer ..	
Jeparit A. and P. Society	H. Whitton ..	Jeparit	
Kangerong and Dromana A. and H. Society	G. H. Rogers ..	Dromana ..	
Kaniva A. and P. Society	D. Harris ..	Kaniva	
Koroit Ag. Society	—	Koroit	
Korong P. A. and H. Society ..	J. R. Gray, Jun. ..	Wedderburn ..	
Korumburra Ag. Society	H. Gillard ..	Korumburra ..	
Kowree Ag. Society	—	Edenhope ..	
Lang Lang P. A. and H. Society ..	J. S. Smethurst ..	Yannathan ..	
Lillimur District Ag. Society ..	—	Lillimur ..	
Macedon and Woodend Settlers' and Selectors' Association	A. E. Tidd ..	Macedon ..	
Meeniyan Ag. Society	N. R. Dike ..	Meeniyan ..	
Minyip and District A. and P. Soc.	J. D. Heckle ..	Minyip ..	
Mornington Ag. Society	—	Berwick ..	
Mornington Farmers' Society ..	A. Duff	Cranbourne ..	
Mount Alexander, &c., Ag. Society	—	Castlemaine ..	
Mount Wycheproof Ag. Society ..	—	Wycheproof ..	
Nathalia and Lower Moira A. P. and H. Association	A. E. Heighway ..	Nathalia ..	
Natimuk Ag. Society	—	Natimuk ..	
North-Eastern Ag. Society ..	—	Murchison ..	
North-Western Ag. Society ..	—	Inglewood ..	
Omeo A. and P. Society	W. Wilson ..	Omeo	
Orbost Ag. Society	—	Orbost	
Port Fairy A. and P. Association ..	W. T. Hattam ..	Port Fairy ..	
Pyramid Hill and District A. and P. Society	M. J. Ryan ..	Pyramid Hill ..	
Rochester Ag. Society	—	Rochester ..	
Rutherglen and Murray Valley A. and H. Society	A. A. H. Thompson	Rutherglen ..	
Seymour Ag. Society	—	Seymour ..	
Swan Hill District A. and P. Society	H. V. Cato ..	Swan Hill ..	
Talbot Society	—	Talbot	
Tennyson Farmers' Association ..	C. A. Yeaman ..	Tennyson ..	
Terang Progress Association ..	—	Terang	
Thorpdale Farmers' Association ..	—	Thorpdale ..	
Traralgon Ag. Society	—	Traralgon ..	
Tungamah Ag. Society	—	Tungamah ..	
Undera Farmers' Union	—	Undera ..	
Victorian Ag. Society	—	Kangaroo Ground	
Villiers, &c., Ag. Society	—	Warrnambool ..	
Wandiligong and Bright Ag. Society	—	Wandiligong ..	
Warracknabeal Ag. Society ..	—	Warracknabeal	
Warragul and West Gippsland A. and H. Society	C. S. Affleck ..	Warragul ..	
West Bourke Ag. Society	Dr. D. H. S. Murdoch	Romsey ..	
Whittlesea Ag. Society	J. E. Steer ..	Whittlesea ..	
Yackandandah A. P. & H. Society	M. Clune	Yackandandah ..	
Yarrawonga Ag. Society	—	Yarrawonga ..	

Horticultural Societies.

Society.	Secretary.	Address.	Date.
Victorian Hort. Improvement Society	Chas. G. Blakely	48 Arnold-street, South Yarra	June 18th
Mildura Hort. Society	G. T. arries	Langtree Avenue, Mildura	June
Royal Hort. Society of Victoria—Daffodil Show	W. R. Church	Prell's Buildings, Collins-st., City	September
North Suburban Hort. Society	C. C. Osborne	"Corona," Bastings-st., Northcote	October
Royal Hort. Society of Victoria—Rose, &c., Show	W. R. Church	Prell's Buildings, Collins-st., City	November
Kyneton Hort. Society	W. Baker	Green Hills P.O., *viâ* Kyneton	November
Allandale District Hort. Society	J. J. Bail	Broomfield	
Bacchus Marsh Hort. Imp. Society	F. Howe	Bacchus Marsh	
Ballarat Hort. Society	T. Mitchell	92 Peel-street, Ballarat East	
Bendigo Hort. Imp. Society	W. H. Walter	City Chambers, Bendigo	
Brighton Hort. Society	C. L. Rees	Bay-street, North Brighton	
Buninyong Hort. Society	E. M. Tonkin	Buninyong	
Casterton Hort. Society	Herbert N. Jacobs	Casterton	
Castlemaine District Hort. Society	P. C. Baker	Castlemaine	
Clunes Hort. Society	—	Clunes	
Colac Hort. Society	—	Colac	
Collingwood Hort. Society	E. A. Saxton	Queen's Parade, Clifton Hill	
Diamond Creek Hort. Society	C. C. Lawrey	Diamond Creek	
Eaglehawk Hort. Society	—	Eaglehawk	
Fitzroy Hort. Society	J. Whiffen	34 Keen-street, North Fitzroy	
Footscray Hort. Society	—	Footscray	
Frankston Hort. Society	. N. arsh	Langwarrin	
Geelong Hort. Society	—	Geelong	
Hamilton Hort. Society	—	Hamilton	
Hampden, &c., Hort. Society	—	Camperdown	
Harrow Hort. Imp. Society	—	Harrow	
Hawthorn Hort. Imp. Society	T. W. Stillman	"The Olderfleet," 475 Collins-st, City	
Healesville Hort. Society	H. R. Thomas	Healesville	
Horsham District Hort. Society	—	Horsham	
Inverleigh Improvement Associat'n.	—	Inverleigh	
Kilmore Hort. Society	—	Kilmore	
Linton Hort. Society	Wm. Nicholls	Linton	
Moorabin Hort. Poultry & Dog Soc.	F. W. McKittrick	South Brighton	
Portland Hort. Society	—	Portland	
Port Fairy Hort. Society	W. T. Hattam	Port Fairy	
Ringwood & Districts Hort. Society	A. E. M'Comas	Montrose, Croyd'n	
Rutherglen Hort. Society	—	Rutherglen	
South Suburban Hort. Society	J. M. Molloy	107 Greville-st., Prahran	
Tallangatta Hort. Society	—	Tallangatta	
Terang Hort. Society	—	Terang	
Wandin District Society	—	Wandin Yallock	
Williamstown Hort. Society	—	Williamstown	
Woori Yalloak Hort. Society	—	Woori Yalloak	
Yarra Glen Hort. Society and F. Gs.' Association	E. C. Morris	Steel's Creek P.O.	
Yarrawonga Hort. Societ	—	Yarrawonga	

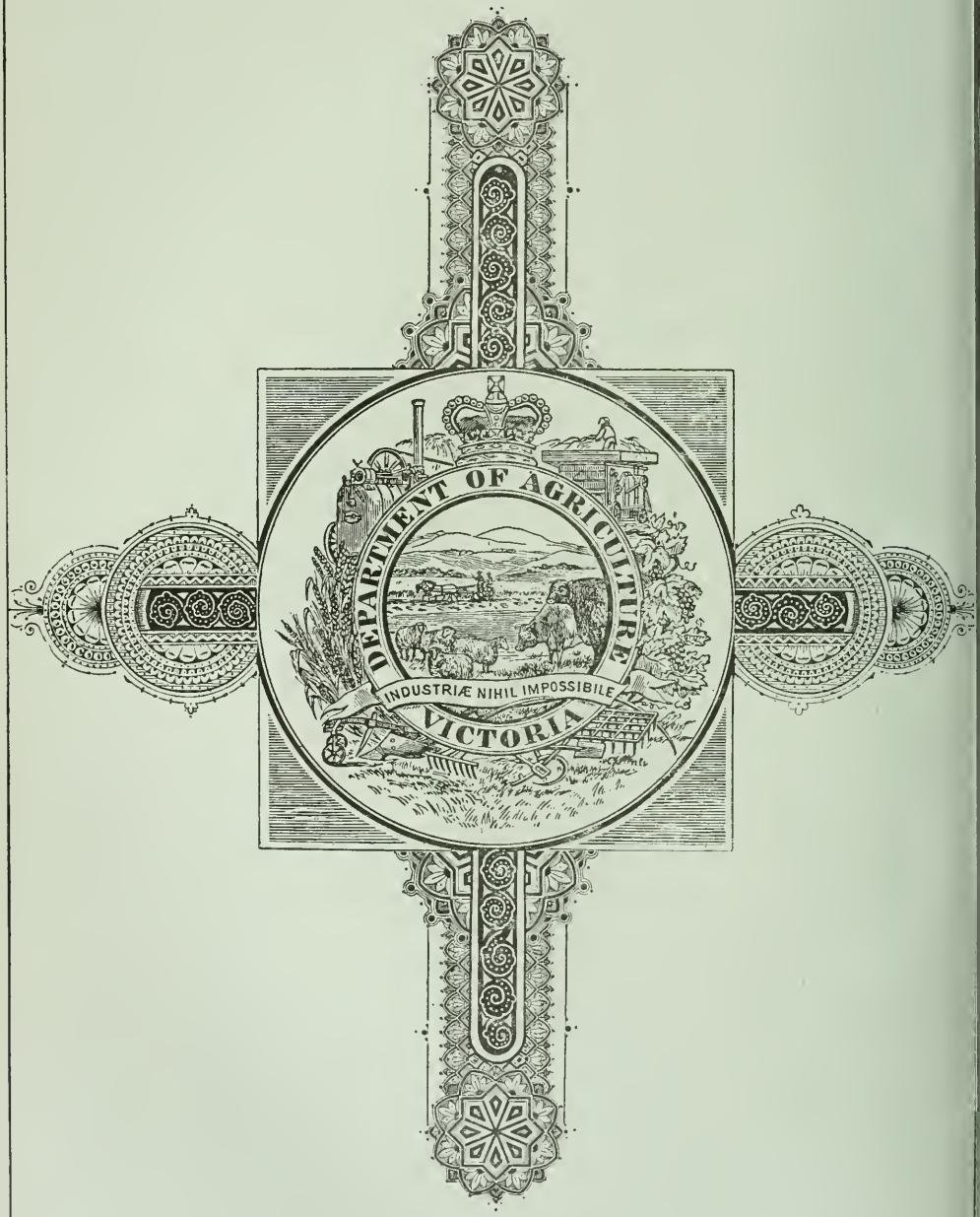
Vine and Fruit Growers' Associations.

Society.	Secretary.	Address.	Date.
			1904
Cohuna F. Gs.' Association	H. Safe	Gannawarra	February
Wodonga W. and F. Gs.' Assn.	O. Batt	Wodonga	February
Arthur's Creek F. Gs.' Association	F. K. Phillips	Brookside, Hazel Glen	
Bairnsdale F. Gs.' Association	J. Yeates	Bairnsdale	
Barnawartha V. and F. Gs.' Assn.	A. B. Barlow	Barnawartha	
Beaconsfield, Gembrook, & Pakenham Hort. and F. Gs.' Association	Geo. W. Martin	U'pr Beaconsfield	
Bendigo V. and F. Gs.' Association	J. Kahland	Bendigo	
Boort V. and F. Gs.' Association	R. I. Kewish	Boort	

VINE AND FRUIT GROWERS' ASSOCIATIONS—*continued.*

Society.	Secretary.	Address.	Date.
Booroondarra, Nunawading, & Mulgrave Hort. and F. Gs.' Assn.	J. B. Brewer	"St. John's Wood," Burwood	
Briagolong V. and F. Gs.' Assn.	T. L. Crespin	Briagolong	
Bright District V. and F. Gs.' Assn.	A. Turnbull	Bright	
Buckrabanyule District V. and F. Gs.' Association	W. Hindson	Buckrabanyule	
Buln Buln F. Gs.' Association	J. C. Young	Drouin	
Castlemaine District F. Gs.' Assn.	O. Bertuch	Walmer, *viâ* Castlemaine	
Central Wine Assn. of Victoria	J. W. Bear	Market-st., City	
Cobram W. and F. Gs.' Association	G. H. Clarke	Cobram	
Doncaster F. Gs.' Association	W. A. Webb	Doncaster	
Dookie V. and F. Gs.' Association	F. de Castella	Dookie	
Dromana F. Gs.' Association	A. Holloway	Dromana	
Drouin F. Gs.' Association	S. Nicken	Drouin	
Dunolly W. and F. Gs.' Association	P. J. Daly	Dunolly	
Echuca F. Gs.' Association	W. Ponsford	Echuca	
Euroa V. and F. Gs.' Association	—	Euroa	
Garfield F. Gs.' Association	C. Pitt	Garfield	
Geelong and Western District V. and F. Gs.' Association	M. J. Wright	Ryrie-st., Geelong	
Goulburn River and Nagambie V. and F. Gs.' Association	—	Nagambie	
Goulburn Valley F. Gs.' Association	H. Pickworth	Ardmona	
Great Western and District V. Gs.' Association	H. Salinger	Great Western	
Harcourt F. Gs.' Imp. Association	E. Pritchard	Harcourt	
Horsham and Wimmera District F. Gs.' Association	E. Fraser	Horsham	
Huntly F. Gs.' Association	T. Clay	Huntly	
Kara Kara V. and F. Gs.' Assn.	T. Benson	Winjallok	
Katamatite W., F., and Special Products Association.	C. Loof, sen.	Katamatite	
Kinglake F. Gs.' Association	J. W. Alexander, jn.	Kinglake	
Kyabram and District V. and F. Gs.' Association	A. Mellis	Kyabram	
Lancaster F. Gs.' Association	E. T. Dowling	Lancaster	
Lockwood F. Gs.' Association	J. C. Clarkson	Lockwood	
Maryborough District V., F., and Special Products Association	F. J. Dudley	Maryborough	
Middle Bridge V. and F. Gs.' Assn.	A. J. Copsey	Middle Bridge	
Mildura F. Gs.' Association	F. J. Hawkes	Mildura	
Mooroopna and Shepparton W. Gs.' Association	J. Mornington	Mooroopna	
Nagambie and District W. and F. Gs.' Association	L. A. Gugger	Tabilk	
Nathalia V. and F. Gs.' Association	John L. Glasson	Nathalia	
Nhill and West Wimmera F. Gs.' Association	P. Mackenzie	Nhill	
Numurkah F. Gs.' Association	S. G. Thompson	Numurkah	
Numurkah V., F., and Special Products Association	W. G. McKinney, jn.	Numurkah	
Quantong F. Gs.' Association	Wm. Robertson	Quantong	
Queenstown F. Gs.' Association	—	Queenstown	
Rhymney W. and F. Gs.' Association	T. O'Brien	Rhymney	
Ringwood F. Gs.' Association	G. A. Williams	Ringwood	
Riverside F. Gs.' Association	C. C. Debney	Riv'side, Horsham	
Rutherglen and Murray District V. and F. Gs.' Association	A. H. Thompson	Rutherglen	
Shepparton V. and F. Gs.' Assn.	—	Shepparton	
Somerville F. Gs.' Association	S. S. Gault	Somerville	
South Gembrook F. Gs.' Association	G. H. Windsor	Pakenham	
Stawell District W. and F. Gs.' Association	G. B. N. Bristow	Stawell	
Tarranginnie W. and F. Gs.' Assn.	J. C. Farmers	Tarranginnie	
Tonimbuk F. Gs.' Association	S. Nicholson	Tonimbuk	
Victorian F. Gs.' Association	J. S. McLean	Harding-street, Surrey Hills	
Wandin F. Gs.' Association	J. Rouget	Wandin Yallock	
Wangaratta District V. and F. Gs.' Association	W. Swan	Londrigan	
Wedderburn F. Gs.' Association	J. R. Gray, jun.	Wedderburn	
Yarragon and District F. Gs.' and Rural Society	B. H. Crook	Yarragon	
Yarra Valley V. Gs.' Association	M. C. G. Hutton	Lilydale	
Yarrawonga District V. and F. Gs.' Association	W. Parsons	Yarrawonga	
Yarrawalla, Mologa, and District V. and F. Gs.' Association	C. Marfleet	Yarrawalla	

NOTICE.—It will be an advantage to each Society to have the date of its forthcoming Show duly announced, and Secretaries are requested to furnish the Editor with the requisite information for publication in these columns.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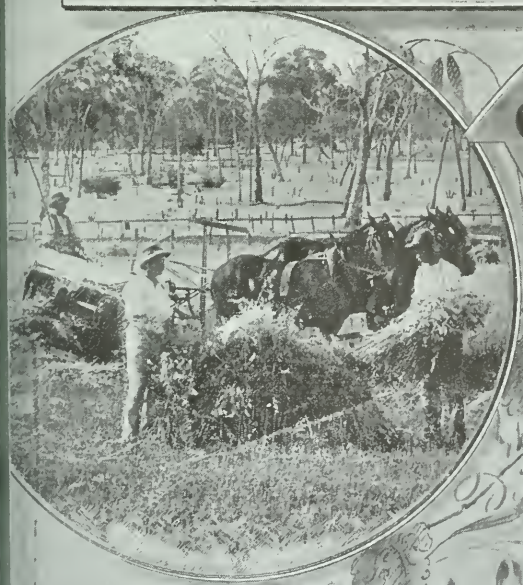
The Journal of the Department of Agriculture of Victoria



September

1903.

Vol II. Part 3. SEPTEMBER, 1903.

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OF

VICTORIA.

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Minister for Agriculture.

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1903

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ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE.

A REVIEW OF THE YEAR'S WORK.

By S. Williamson Wallace, Director of Agriculture.

The past year will long be remembered by the rural population of this State as being the year of the severest drought ever experienced since the country north of the Dividing Range has been brought into cultivation. Though severe droughts have previously been recorded, these affected only the flocks and herds which then occupied the dry areas. The drought of this year has fallen heavily on the people who more recently settled in that country and devoted their attention chiefly to wheat production, instead of stock raising.

Excepting the irrigated portions of the Goulburn Valley, and a few patches near the South Australian border which were favoured with passing thunder showers, the wheat crop was almost a complete failure over the whole country north of the Dividing Range. Not a vestige of grass was to be seen on the pastures, and the country became almost denuded of stock which had died or had been removed south to be pastured in Gippsland and the Western district.

The Government advanced £100,000 as loans to farmers to enable them to buy seed wheat, and fodder for working horses. Although this sum was far short of the requirements of those who had not the money to purchase seed for themselves, yet a very large area of wheat has been put in and promises to be the best crop grown for years.

The drought which proved so disastrous in the north raised the price of fodder and rent of grazing areas in the south, so that, excepting for those engaged in dairying, the southern farmers benefited largely from the drought in the north of Victoria, and in New South Wales.

At no time have the advantages of irrigation been so clearly demonstrated in the State. In the Goulburn Valley, where irrigation was possible, the luxuriant growth of lucerne and heavy crops of hay stood out in vivid contrast to the barren paddocks which had not been watered, and where crops had entirely failed. The lesson has been a severe one, but the conversions to the advantages of irrigation have been more numerous than they would have been in several years with average seasons. To me it has always been a puzzle why anyone should decry irrigation, yet I have met many in Victoria who do so. I can only explain this by the fact that the farmers have not been long accustomed to the use of water, and where mistakes were made, with failure as the result, irrigation has been blamed, not the mis-use of the water.

At the earliest possible time, when money can be found for the purpose, a Government irrigation farm should be established. In connection with such a farm, there should always be a small area devoted to experimental work, where different crops should not only be tried, but the same crops irrigated at varying times and results carefully tabulated and published over a series of years. The main object of such a farm should be to make it pay, and demonstrate the financial advantages of irrigation.

The reports of the Heads of Branches deal thoroughly, though concisely, with the work of the department, consequently it remains only for me to discuss the most prominent points in these reports. The straitened state of the finances of the country has prevented money being granted for more extended field investigations and for systematic experiments and research, which would have led to the more rapid development of the agricultural resources of the country. Yet the reports show that as much solid work has been done as formerly, and, except for heart-burnings on the part of individual officers who well deserved increased pay, the department has not seriously suffered from this year of retrenchment, except in the cases of experts who have left it for various reasons, and whose places have not been filled.

The Chemical Branch.

In the Chemical branch the most important new work undertaken in the field was the forage experiments in the southern areas, which undoubtedly point to the possibility of greater varieties of forage crops being grown than has formerly been the case. Maize as a forage crop was almost the only one hitherto thought of, while it is now demonstrated that several others are quite as good if not better, and have been found to excel maize both in bulk and feeding qualities. The work involved in these co-operative experiments is very considerable, and the expense to the State is by no means a small item before correct information can be collected. It is, consequently, much to be regretted that numbers of farmers after having agreed to experiment, and the plots had been put in under the supervision of an officer of the department, the seed and manure being supplied by Government, deliberately cut the crops before results had been obtained, rendering the whole experiment useless. On the other hand, the department is deeply indebted to the greater number who loyally carried out the experiments to the end, taking a great deal of trouble in cultivation as well as assisting in every way to obtain correct results.

All dairy farmers should read *Bulletin No. 6* of the Department, or the article on the subject by Dr. Howell which appears in the July number of the *Journal*. Experiments in the field also show that poor land in the moister areas can be successfully brought into paying cultivation by the use of artificial manures, although these lands could not hitherto be profitably cultivated without manure. The demonstration of this fact is of an immense importance, considering the great extent of this class of soil in the State.

The department is still without experimental farms, or the money to establish them. On these farms experiments of a more complex nature than those above-mentioned, such as experiments lasting over a series of years, should be conducted. For example, the department should be able to state which are suitable rotations of crops, not from known practices in other countries but from a knowledge of facts gained by experiment in this State. The effects of manures on the crops of the following season are known very little of in Victoria, and are little calculated upon when farmers are considering whether they will manure or not. These effects should be ascertained on experimental farms, and I am of opinion they will be found to be very considerable in the moister areas, where larger quantities of manure are required than in the drier areas. Phosphatic manures are principally used, and these do not leach out of the soil in the same way that nitrogenous manures do. If nitrogen had been the principal ingredient required, then the knowledge of after results would have been of less importance.

The analytical work of this branch is steadily increasing, and must increase with the extended use of fertilisers. A systematic analysis of soils on land on which crop experiments have been conducted was undertaken last year by the Chemist for Agriculture, who after a number of years of experiment, accompanied by analysis, will be in possession of accurate facts which will enable him to state more correctly how soils ought to be manured in the various districts where climatic conditions are similar. To obtain this necessary and useful information involves a great amount of work—consequently expense—but, when obtained, will be of the greatest benefit to farmers who pay for the analysis of their soils.

Amendments to the present Manure Bill, which is practically inoperative, will place more power in the hands of the department, which would be used for the purpose of protecting farmers against unscrupulous manure dealers. The amended bill is supported by the best firms in the trade, who will welcome any measure which would facilitate the detection of fraud.

The field, analytical, educational, and clerical work of the branch have been ably conducted by Dr. Howell and the staff of officers under his control.

Vegetable Pathology.

The work of the Vegetable Pathologist in this State is of great importance to producers, as many fungus diseases have got a very firm hold on the crops and fruit of Victoria.

Mr. McAlpine is steadily endeavouring by experiment to find remedies, and his efforts have been specially directed to those which cause the greatest loss to growers. The way in which he has demonstrated that the black spot of the apple can be almost entirely prevented by spraying is of the utmost importance to orchardists, in

view of the fact that the Vegetation Diseases Act, which prohibits the sale of diseased fruit in the market, is on the recommendation of the Vegetation Diseases Board to be strictly enforced next season.

The discovery of a rust resistant wheat which would give a heavy yield, and at the same time possess the best milling qualities, seemed almost to have been made in the variety known as Rerraf, but since its distribution some doubt as to its milling qualities has been raised. Every effort will be made to find a wheat which will possess all three qualities, and it is mainly with this object that experiments have been conducted over a series of years at Port Fairy.

Closely associated with this class of work is the testing of new varieties of imported grains, which has been undertaken by the Vegetable Pathologist. The great success of Garton's hybrids in England leads us to hope that some of them may be found to be suitable to the climate of Victoria, and I have made arrangements to import those which show the best results in the present experiments so that farmers may grow them in various parts of the State next year, and test their suitability to different districts.

The discovery of a grass which can be sown in the northern areas for the purpose of forming a permanent pasture, after the land has been under cultivation is a matter of great importance. The problem has not yet been solved, and until it is solved the Department of Agriculture should never give up the task. With this view experiments have been undertaken with numerous grasses imported from America, as well as our own native species.

Dairy Produce Exports.

The Manager of the Government Cool Stores has furnished an excellent report which is well worth reading by all producers. My experience of one export season in Victoria has forcibly impressed me with the fact that a sufficiency of cool storage is the keystone of the situation. All other efforts of the department and producers are in vain, if we cannot market our perishable products when they are ready for market. What is the position at the present time? Last year the supply of cool storage available was not equal to the demand for two months of the export season. The Government Cool Stores could not deal with nearly all lambs and sheep offered. Had it not been for the railway strike, we would have been short of accommodation for 25,000 crates of rabbits, and this in the very worst drought year that has ever been experienced.

This year we have every prospect of having an excellent season, and a large export of butter, lambs and mutton. Last season 180,000 carcases were handled by the department, and the present prospect is that not less than 300,000 will be offered. What will be the result? Lambs will be kept long after they are prime and will deteriorate in value, and if kept on the stations will eat off the feed which

ought to be kept for stock that have to be wintered. A proportion will be rushed in for sale, the markets will become glutted, and prices will fall all round. Whereas, if sufficient cool storage were provided, the price of lambs and mutton in Melbourne would be ruled by London and not by an over-supplied local market.

It may be argued there would be a great loss to the Government in maintaining a sufficient amount of cool storage to meet all seasons of plenty. This, however, need not be the case. Last year, for example, when the export of butter was reduced to a minimum, the loss on the export business was less than £400, although the rent of the cool stores is £15,000 per annum—an exorbitant sum. If an addition of 1d. per carcase had been charged on lambs and sheep, several hundred pounds profit would have been made on the year's transactions. If this is the financial result in a bad year, I think there is little need to dread any loss that might occur from over expansion. In any case, such loss could always be recouped in a good season, and would not be one-hundredth part of the loss entailed upon producers owing to the want of space.

All fruit exported should first be chilled before shipment, and would be so chilled if space were available. This would allow outside lines of steamers to compete against mail steamers, and would cause a reduction of rates equal to £3,000 on 60,000 cases, which was the volume of our exports to England last year. From this the orchardists would benefit not only in freights, but in the fact that their fruit would carry better.

Voluntary grading of butter will be undertaken this year, which will enable proprietors of factories to sell in advance to merchants who previously have found it difficult to operate in Victoria, although buying largely in New Zealand. The deterioration of butter by the abuse of the home separator is a serious matter, and, if not checked will detrimentally affect the industry. I would deal with this evil by Act of Parliament in a very simple but drastic manner. The act would provide that all sellers of milk and cream, creameries, factories, and separators, be licensed, and fees charged for the licenses sufficient in amount to pay the cost of inspection. Powers would also be provided so that inspectors could cancel the license of any dairyman whose cream or milk was not delivered at the factory or railway station in a sound condition. This would end the evil in a very few months, as those whose licenses were cancelled would soon find means to deliver their cream in a satisfactory condition.

The home separator is a great convenience to many farmers, and its use will increase. We must take its existence as a settled matter, and provide means for preventing its mis-use.

The improvement of the quality of Victorian cheese is a very simple matter. The factories are so few that one good instructor could raise the quality of the production all over the State in twelve months. That there will be little or no improvement without instruc-

tion is evident. The factories are so far apart that there is no intercourse between the different makers, so that they learn nothing from one another as they do from intercourse in England. A cheesemaker may go on in blissful ignorance, thinking he is producing excellent cheese, though it is a very ordinary product. When we consider that there is a duty of 3d. per lb. and freight to pay on imported cheese, there ought not to be a single pound of New Zealand cheese sold in Australian markets. The climate is favourable, good cheese can be made with instruction, and instruction alone will accomplish the desired result.

The export of rabbits and poultry, and the preserving of eggs by cool storage, has been well superintended by Mr. Hart. Although the number of poultry exported have decreased owing to the drought and the dearness of grain, yet the quality of those exported from the Government Cool Stores has been maintained. The preserving of eggs in cool storage ensures higher prices during the season of plenty, and keeps eggs at a moderate price during the season of scarcity. These results will encourage farmers to increase their stock of poultry and be a benefit to consumers as a whole.

Inspection of Rural Industries.

The report of the Inspector of Rural Industries gives a concise yet thorough description of the work of his branch without introducing material which would more properly be dealt with in special articles.

Although this year charges have been made for inspection of produce, and railway carriage charged for the transport of exhibits to shows, the number of inspections has not been curtailed, nor the number of shows visited been lessened, which demonstrates that the inspection is of real commercial value, and that the exhibits are so popular that they are keenly sought after by agricultural societies.

The educational work that Mr. Knight is engaged in, especially the encouragement of such industries as flax growing, will be more highly appreciated when the prices of the staple products of the farm have fallen to normal levels. When hay is £2 per ton and wheat 3s. per bushel, there will be more enquiry as to the value of special products. It is, therefore, the duty of the department to foster these industries meanwhile.

Stock Inspection.

The report of the Chief Inspector of Stock shows that the outbreaks of contagious diseases amongst stock have been few during the year. Considerable publicity was given, however, to an outbreak of anthrax amongst cows at Braybrook owing to the necessity of adopting stringent measures in the interests of public health.

Although cattle have been comparatively free from disease, the outbreak of swine fever is a calamitous event, both for the pig owners

and dairymen. The existence of swine fever was first announced to me by Dr. Brown, Inspector of Foods for export, who, after careful bacteriological examination and experiments in inoculation, was very positive in his opinion that he had discovered swine fever. He, unfortunately, stated at the same time that swine fever had long existed in the State, and that he had himself seen the disease in Gippsland several years ago. This entirely shook my confidence in his diagnosis, and I at once told him that I could not, without further corroborative evidence, take the responsibility of announcing that swine fever was in the State, and recommending the Honorable the Minister to pass the stringent regulations which I knew were necessary to cope with this disease, seeing that Dr. Brown asserted this was the same disease which had been prevalent amongst swine for years. The Stock Branch was informed of Dr. Brown's opinion so that it might be able to obtain corroborative evidence that the disease really did exist in the State. Evidence came later from Mr. Cameron, Veterinary Surgeon to the Board of Health, and from Dr. Bull, of the Melbourne University. Within forty-eight hours of Dr. Bull's report being received, the districts where swine had lately died were quarantined, but as cases were discovered, to exist outside the quarantined areas I recommended the Hon. the Minister to declare the whole of the State, an infected area, and to apply the stringent regulations which are at present in force until the districts could with certainty be declared clean.

The onus of proving that districts are clean has been thrown on the people themselves, and although this on first sight may seem hard, it will not be so disastrous to the country as if these regulations had not been enforced and the whole of Victoria had become infested, which undoubtedly would have been the case.

Inspection of Frozen Meat Exports.

The Inspector of meat for export reports that twice as many carcases of sheep and half as many lambs were exported during the year under review than was the case the previous year. This increased quantity of sheep is accounted for by the overstocking of Gippsland and the Western district with starving stock from the North and from New South Wales. When keep became scarce in the South these had to be slaughtered, so that the country could carry the remainder without loss.

It is satisfactory to note that the quality of exported sheep and lambs was better than the previous year. It is estimated that the coming season will show a great increase in the export of mutton and lamb which I can well understand, as feed will be so plentiful that all stock will be in excellent condition and fit for export, while last year great numbers were either canned or boiled down.

Scientific Instruction in Dairying.

Dr. Cherry, Bacteriologist and Scientific Dairy Expert, has been occupied most of his time in lecturing to farmers and teaching applied

bacteriology to employes of butter factories This educational work in my opinion is of the greatest service to the State, especially when it is carried to those who can immediately apply the instruction given. Continuous instruction for two weeks to factory employes is in my opinion the best way that the bacteriologist can employ his time so long as a sufficient number of employes can attend at one centre. Unfortunately the period of the year in which dairy managers have leisure to attend classes is the same season in which short courses of instruction are given to farmers' sons, consequently I have reluctantly had to lose Dr. Cherry's valuable services in this particular branch of educational work.

The School of Horticulture.

At the close of last session in December, the number of male students entered upon the roll at Burnley School of Horticulture was six, and two were on probation. It was then determined by the Honourable the Minister to charge a fee of £5 per annum for instruction to test the *bona fide* desire of orchardists for such a school. The result has been most gratifying. There are now 14 male students on the roll. This is a striking example of what one often sees—that what people get for nothing they do not appreciate.

The surroundings of the school have been greatly improved under the management of the Principal, so that there will be increased facilities for outdoor instruction in the future. The six demonstration orchards in the country are of the greatest benefit to those entering upon orchard work, as they can there see demonstrated what steps they should take to plant and maintain a profitable orchard.

Entomology.

The report of the Entomologist shows that useful work is being done by the officers of this branch. Mr. French, besides performing his duties as entomologist, is responsible for the proper administration of the Vegetation Diseases Act, and has also undertaken the supervision of certain experiments which are being carried out by private individuals for the purpose of exterminating that troublesome weed—the St. John's Wort. These additional duties necessarily occupy much of his time and prevent him carrying out experiments or engaging in research to the fullest of his powers, yet some very important work has been done.

The experiments conducted by his officers under his guidance in proving that the Codlin moth can be combated in the orchard, and at least four-fifths of the fruit can be gathered clean, is one of the main arguments why the Vegetation Diseases Act should be strictly enforced and all sellers of diseased fruit rigidly prosecuted. I am certain there will be great opposition to these prosecutions next season, but protests will be of no avail. Consequently strict attention should be given at the proper season to combat the various pests which cause disease.

The experiments conducted by the Chemical branch and by private individuals have proved that St. John's Wort may be checked from spreading in the alarming way in which it has done during the past few years. Now that a remedy has been found tenders will be called for its destruction on experimental areas of considerable extent before the work of eradication is commenced on a large scale. There is, however, no longer any excuse for private owners allowing small patches to remain on their holdings and thus form other centres of infection to the surrounding country.

The Viticultural Industry.

The Viticultural Inspector, Mr. Adcock, presents an exhaustive and interesting report on the work done in this branch. The fact that phylloxera has appeared in the vineyard at the Rutherglen Viticultural Station is a serious loss and practically renders this station useless for the supply of resistant stock to any part of the State, except those already affected with phylloxera. I anticipated this disaster last year and had new nurseries established in clean districts, namely, at Leongatha and Longerenong, with cuttings brought from Rutherglen before phylloxera was known to exist there. There is little doubt but these nurseries are clean. I will have them tested, however, by planting European vines in the immediate proximity of the nursery so that if phylloxera is there it will be soon discovered. When these nurseries have been proved to be absolutely safe we will then be able to begin the reconstruction of vineyards in clean areas. At present viticulturists in clean areas will not take the cuttings from Rutherglen, although the experts of the department declare there is no risk after fumigation, but considering the easy way in which phylloxera can be carried, I am not surprised at their caution.

Agricultural Classes.

The short courses of instruction to farmers and farmers' sons conducted at three centres last winter for a period of two weeks at each were a conspicuous success. An average of 40 students was in attendance at each centre. These results encouraged me to again open classes for one month at six centres this winter where an average attendance of 40 students was guaranteed. A full report of the work of these classes will appear in the *Journal* on a future date.

All officers lecturing at these classes took special trouble to prepare material for lectures and to aid in every way the success of the new departure. The greatest burden of the work has fallen upon the officers of the Chemical branch, and I am especially pleased with the way these young officers acquitted themselves. Dr. Howell is to be congratulated on the manner in which he has trained his staff.

The Journal of Agriculture.

After seven monthly issues of the *Journal of Agriculture,* the publication was suppressed for five months as a measure of retrenchment.

After this suspension it was again issued on the 1st May on the understanding that it was to be made to pay, and will be continued bi-monthly.

Producers who formerly were supplied free of charge have now been asked to pay an annual subscription of 2s. 6d. for the six issues, while sixteen pages of advertisement will be inserted to make up any deficiency.

A record of the work of the department, especially the experimental work, is an absolute necessity if the full benefit is to be derived by the public.

The *Journal* continues to be ably edited by Mr. McAlpine, who spares no pains to make it a success and a credit to the Department.

REPORT OF THE CHEMIST FOR AGRICULTURE.

F. J. Howell, Ph. D.

The work of the branch in its three spheres of activity—analytical experimental and educational—has shown developments during the past year of a very satisfactory nature. The analytical work has already up to a certain date received consideration in a report called for specially by the Director. The many demands being made upon the laboratory, and the totally inadequate remuneration made to the staff, appeared to necessitate greater publicity of the operations of the laboratory. A consideration of the number, the nature and the importance of the lines of investigation dealt with in the present report will indicate the extent of the operations of the branch and suggest, I hope, the desirability of affording every support for legitimate expansion.

The Analytical Work.

The analytical operations, in which my Senior Analyst, Mr. Scott, exercises direct supervisory powers, embrace the work of three departments, those of Lands, Agriculture and Water Supply. As in each department there is evidence of a distinct service to be rendered by the investigations and the advice of the Chemist, it may be accepted that the demands of each of these departments will increase from year to year. The large areas of land of low natural fertility, which have been regarded in the past as practically useless for agricultural purposes, give promise under suitable treatment of being convertible into profitable holdings by the investigations and advice of the Chemist, and the field for activity in this direction seems a very wide one. The very prominent attention being given in Victoria to all matters affecting the health of the people, will not long tolerate a system of country water supplies without some attempt at either a wholesale or household system of purification. With a more general recognition of the necessity for bringing all these supplies under periodic chemical and bacteriological examination, there must be in this direction also a great expansion in the work of the Chemist to a Water Supply Department. In the matter of agriculture the field for chemical activity is a limitless one. I shall not attempt to enumerate the various directions in which chemical knowledge may assist farm practice, but will deal only with work actually carried out during the past year. The following were the samples received for analysis :—

LIST OF SAMPLES RECEIVED FOR ANALYSIS.

	1902-3.
Manures	269
Soils	278
Waters	144
Vegetable Products	363
Dairy and other Animal Products	110
Mineral Deposits considered of Agricultural value ..	17
Miscellaneous	66
	1,247

The beet analysed at the Maffra Factory is not included in this total.

THE SAMPLES CLASSIFIED.

THE MANURES INCLUDED :—

93 samples of Superphosphate
6 ,, ,, Thomas Phosphate
35 ,, ,, Bonedust and Bonemeal
30 ,, ,, Guano
7 ,, ,, Rock Phosphate
39 ,, ,, Gypsum
10 ,, ,, Nitrate of Soda
5 ,, ,, Sulphate of Ammonia
14 ,, ,, Potash Chloride
4 ,, ,, Potash Sulphate
1 ,, ,, Kainit
10 ,, ,, Refuse Manure
8 ,, ,, Blood Manure
2 ,, ,, Marl
5 ,, ,, Special Manures, horticultural, potato, garden, hay and cereal

OF THE MANURES RECEIVED :—

75 samples were from Manure firms
78 ,, ,, ,, Farmers and Farmers' Associations
38 samples were for yearly determination of Unit Values
78 samples were for use on Experimental Fields

WATERS.

THE WATERS INCLUDED :—

96 samples for Sanitary Analysis
11 ,, ,, Stock Purposes
7 ,, ,, Boiler and Locomotive Use
12 ,, ,, Butter Washing Purposes
11 ,, ,, Use in Irrigation
7 ,, ,, Mineral Springs

OF THE WATERS RECEIVED :—

109 samples were from the Water Supply Department
19 samples were from Farmers
1 sample was from the Stock Branch
12 samples were from the Dairy Branch
3 samples were from the Lands Department

SOILS AND SUBSOILS.

OF THE SOILS AND SUBSOILS RECEIVED :—

32 samples were received from the Lands and Public Works Departments
5 ,, ,, ,, ,, ,, Viticultural Branch
81 ,, ,, ,, ,, ,, Farmers
137 ,, ,, ,, ,, ,, Experimental Fields
12 ,, ,, ,, ,, ,, Tobacco Lands of Edi
12 ,, ,, ,, ,, ,, Mildura Settlement

ANIMAL PRODUCTS.

The Dairy Samples included :—

19 samples of Butter
2 ,, ,, Cheese
15 ,, ,, Milk
3 ,, ,, Biestings
2 ,, ,, Cream
1 ,, ,, Eggs
2 ,, ,, Deposits in Cream Separators and Churns
1 ,, ,, Preservative

CANNED MEATS.

65 samples of Canned Meats

VEGETABLE PRODUCTS.

These included :—

7 samples of Fruit
6 ,, ,, Jam and Pulp
1 ,, ,, Sugar
339 ,, ,, Beetroot
1 ,, ,, Bark
2 ,, ,, Wine
1 ,, ,, Oil
1 ,, ,, Raspberry Vinegar
5 ,, ,, Pollen

Total .. 363

MINERAL DEPOSITS.

These included :—

	8	samples of Carbonate of Lime
	7	,, ,, Minerals
	1	,, ,, Whiting
	1	,, ,, Phosphate of Iron
Total ..	17	

MISCELLANEOUS SAMPLES

These included :—

	14	samples of Grasses, Weeds and Fodder Plants
	2	,, ,, Calves Food and Cattlelick
	1	,, ,, Blood in connection with death of pigs.
	41	,, ,, Bluestone
	1	,, ,, Solder used in tinning preserves
	1	,, ,, Tin
	1	,, ,, Spirit
	1	,, ,, Sand from Mining Battery
	1	,, ,, Slime from Mining Battery
	1	,, ,, Scrub Exterminator
	2	,, ,, Fruit Wrappers
Total ..	66	

Remarks on the Analytical Work.

My remarks on the analytical work contained in the special report already referred to, will apply with equal force to the operations under present review. I there wrote :—

"The work of a laboratory is hardly to be judged by the number of samples received, it depends upon the number and the nature of the determinations involved in the analysis of each sample. A complete soil analysis, to take an instance, involving over twenty operations, is a vastly different thing from the determination of one or two ingredients in a sample, although both may be classed as samples. The most of the work of the nature of that carried out in an institution of this kind is, the world over, carried out in duplicate as an absolute guarantee of accuracy, and this naturally greatly increases the work. The number of samples that reached our laboratories last year is greatly in excess of what it ever was before. The wonderful effect of the manures on the soils of the North has influenced considerably the analytical work of the laboratory. With the vast sums of money now spent on fertilizers, it is natural the farmer should begin to clamour for some guarantee of the value of the material he buys. A chemical analysis alone can furnish this guarantee, and it is natural the farmer should look to the Agricultural Chemist for this. The news of the successful use of manures in the North has reached the ears of the farmer in the South, and daily applications are pouring in from this quarter for information as to the probable deficiencies of the soils in that portion of Victoria, and the manures which might most suitably supply them. Conjecture is useless in this case, and soil analysis, where an immediate answer is required, must attempt the answer. The Chemical Branch is endeavouring to properly engage in both laboratory and field investigation, which will allow of answers

to all such similar questions. It is work which of necessity must grow by leaps and bounds. With every new development in field work there will be corresponding demands in analytical investigation. In the examination of manures, especially, I anticipate large developments. The present Fertilizers' Act does not, in my opinion, offer sufficient protection to the farmer. That protection ought to be given if we wish farmers to engage in the fertilization of their lands with confidence. To give that necessary protection it will require the analysis of at least 500 samples a year.

Future field experimental work will, apart from the farmer's demands, largely add to the work of the laboratory. For the manurial requirements of the many crops possible in the South we must look to field experiment, and with field experiment soil analysis should go hand in hand. From the results obtained by the growing crop in the field, and from the soil analysis of the laboratory, we shall secure data for forming opinions as to the proper treatment of similar soil areas of wide extent, and their adaptability for special cultures. As the statement also shows, a large number of water analyses is carried out in this laboratory, many of them to decide the suitability of the samples for agricultural purposes. It is essential to agricultural development, especially in the arid or semi-arid portions of Victoria, that the struggling settler should be freely assisted in this matter. A well or a bore in the far North may be a veritable gold mine or it may be a source of absolute danger. The agricultural laboratory should be at the service of every farmer to inform him of the suitability of his supply for domestic use, for stock requirements, and for irrigation purposes. In the interests, also, of the continued development of the dairy industry, it is essential that the water supply of all butter factories should be under constant chemical supervision by the Department. The use of a pure water in the dairy is of vital importance to both our local and foreign markets. The bluestone used by the farmer in the pickling of his wheat, and the insecticides and fungicides so extensively employed by the fruit grower in the orchard are liable to adulterations which render them useless for the purposes intended. Not only the individual using them, but the whole country might suffer seriously from the effects of such adulterations. The chemical analysis of our various agricultural products, vegetable and animal, requires to be systematically taken up. Profitable farming depends as much upon the quality of what a farmer produces as upon the quantity. To send away wheat or barley or flour deficient in important constituents means going under in the severe struggle for the world's market, when a better article is able to compete. We might send away in unlimited quantities, jams, pulps, preserves, canned meats, and various other articles, but to export these, either wilfully adulterated or unintentionally contaminated with dangerous metallic salts owing to improper methods of canning, is to seriously imperil our prospects of ever building up a great export trade in these lines. This is a matter closely affecting our producers, and every such shipment

that leaves our shores should carry with it the Departmental Chemist's certificate of purity. In the few facts brought forward to illustrate the functions of an office of this kind, it will be seen there is unlimited room for the chemist's activity in safeguarding and furthering agricultural interests."

The work of the past year was carried forward on these lines. A prominent feature of the laboratory operations of the twelve months has been an extensive analysis of manures and bluestones with the view to the detection of low grade or adulterated articles on the market. Both articles, however, have generally speaking come up to approved standards of quality. The analysis of 38 samples of bluestone collected from various sources showed an average impurity of less than ½ per cent. of sulphate of iron. The manures, with few exceptions, have either equalled or exceeded the guaranteed standard of the invoice certificate, A serious cause of complaint, however, is the frequency with which manures appear to be sold in the country without the required certificate. It is also noticed that farmers in the North still appear to purchase nitro-superphosphates rather extensively. Experiments have shown that for the present at any rate the soils of the North do not require nitrogen, and it is a waste of money in purchasing manures containing this ingredient. Farmers in the North are advised not to buy nitro-superphosphates.

Bacteriological and Microscopic Work.

The work of this section has been well carried out by my Biological Chemist, Mr. Price. There were 96 samples of water received for bacteriological and microscopic examination during the year. Periodical examinations were made of a number of the large inland supplies. These included Ballarat, Bendigo, Geelong, Maldon, Mildura, Donald, Charlton, Maryborough, Castlemaine, Boort, Kyneton, Talbot, Moolort, Tallangatta, Bright, Evansford, Mount Emu, Neerim, Korumburra and Warragul. In addition to waters for sanitary purposes, a number of samples were also received from butter factories.

Bacteriological examinations were also made of a number of butters sent in through the Dairy Branch from country districts for prize competition, and photographs taken of the cultures for information as to the bacterial condition of the exhibits.

The examination of bone meals, poultry feeds, jams, meats, etc., for adulterations, also involved a good deal of microscopic investigation. The large use of the microscope in the mechanical analysis of soils added also very considerably to the work of this section of the branch. In the soil investigations of the future, this section should have a sphere of great usefulness.

Educational Work.

The extension of the field operations of the branch, and the daily meetings of the various field officers with farmers in all parts

of the State, have had the effect of stimulating a desire for information on various agricultural matters. This has manifested itself both by a large number of applications for the services of lecturers, and a marked increase in letters of inquiry, bearing upon the work of the office. The large part which officers from this branch have played in the short agricultural courses initiated by the Director has resulted in an output of work by this section of the branch, which has never before been equalled. My travelling assistant, Mr. Lee, has shown special activity, and the kindly notices of the press are indications that he has mastered the duties of a difficult position, and gained the confidence of the farmer. The course of lectures he has delivered has been a comprehensive and instructive one. The facts and literature I placed in his hands rendered possible the preparation and delivery of addresses on the following subjects, which were repeated at various centres:—

The Manurial Requirements of Northern Soils.
How to Cultivate for Wheat Growing.
Rotations, and the Possibilties, in the North.
Salt-bush as a Fodder for Dry Areas.
Manure Experiments in Southern Victoria.
The Beet as a Sugar and Fodder Plant.
Forage Crops.
The Principles of Manuring.
Farmyard Manure.
The Functions of Lime in Agriculture.
Commercial Fertilizers.
How to Value Artificial Manures.
Humus in its Relation to Soil Fertility.
Crops to Provide the Nitrogen Requirements of Southern Soils.
The Principles of Feeding.
The Feeding of Sheep.
Forage Crops for Pigs.
The Food Requirements of Farm Horses.
Silage and Silos.
Rations for Dairy Cows.
Lucerne for Milking Cows.
Feeding for the Production of Beef.

In addition to Mr. Lee, my junior analysts, Messrs. Osborne, Garnsworthy, Robertson and Trend, have also each prepared a series of 20 lectures on theoretical and agricultural chemistry. This necessitated a wide course of reading, a great deal of night work, the cultivation of the art of lucid exposition, and the mastery of a free and easy delivery. They have faced, as a first attempt in lecturing, bodies of men offering as a rule little sympathy for anything not showing a direct connection with farm practice, and have come through the ordeal in a manner of which the head of any branch might feel proud. The enthusiasm and industry shown by these young men are in striking contrast with the indifference to the value of their services shown by their country. They are paid salaries of £50 to £75 per annum.

Field Operations.

The field operations of the past year were conducted on a more extensive scale than at any time in the history of the branch. The work of this section increases in popularity each year, a popularity based upon the results of immediate benefit to the farmer which have followed, and continue to follow, its operations. The wonderful effects following the use of appropriate manures on the poorer soils of the South have opened a new chapter of possibilities in this part of Victoria, and give promise of converting immense areas considered almost worthless into good profitable holdings. The field manure tests of last year were numerous and covered a variety of crops. The results will be given in a separate paper. The forage crop experiments formed a prominent feature in the field operations of the year. A report dealing with the outcome of these experiments has already appeared in the pages of the *Journal*. The field tests with the sugar beet covered an immense area, and practically took in the whole of Southern Victoria. The results of these tests will also require a separate report.

Improvements in the Methods of Conducting Field Tests.

The advisability of training young men for field work possessing a fairly good scientific education has been suggested; and the desirability of making such employment continuous instead of intermittent as at present has also been pointed out. Field experiments, without absolute accuracy and honesty in every detail, are worse than useless. It is only a scientific training—and more especially a chemical training—which can give this accuracy. The intellectual honesty, also, which will truthfully record failures and not exaggerate successes is the outcome, also, of a moral training associated generally with the higher social stages in life. Our field officers have all been drawn from the ranks of farming life. Excellent work has been done with this material; but much better and more satisfactory might be achieved under the altered arrangements referred to. The intermittent nature of the employment under present conditions is calculated to place considerations of self too much above considerations of the Department. I should prefer for my field work a body of well-educated young enthusiasts, who would regard themselves as possible future instructors in the great field of agricultural education which lies before us.

Improvements in the System of Experiments.

The field manure tests might, I think, be made much more scientific, and of a much wider value, if the district as a whole instead of the individual could receive consideration. Under present conditions, we are dependent upon the individual or individuals making application for co-operation in the field tests carried out in a district. There may be half a dozen types of soil in a district, and opportunity is afforded of testing one only, through farmers or the others declining to go to the trouble of engaging in the work with the Department.

Manure tests, including all the types of soil in a district, in conjunction with a survey defining the boundaries of each type, would permit of the mapping of the soils of each district, and, provided laboratory investigations were also carried out in connection with each type, would furnish information applicable to similar areas elsewhere. It is on such lines as these that I would wish the field trials of the future to be conducted.

Experiments at the Tobacco Farm.

Mr. Temple Smith furnishes an interesting report on the experiments carried out on the farm under his direct supervision, the most important of which were different methods for raising plants in the seed beds and the prevention of blue mould. Manure experiments of a comprehensive kind were also carried out, the results of which are not yet available. A number of new varieties were also tested, some of which gave promise of proving valuable introductions. Mr. Smith reports: "Sixteen varieties were tried in all, thirteen of which were pipe tobaccoes. The following facts were noted in connection with the varieties grown on the experimental plots :—

PLUG TOBACCOES.

The Hester.—Nice heart-shaped leaf; leaves well apart. Can be planted 3 feet apart.

Lacks.—Very large long leaf; slow growth; requires to be 3ft. 6in. apart. Should give heavy yield.

Blue Pryor.—Large leaf; matured late; nice texture.

Colonial Broad Leaf.—Strong growth; large leaf; heavy yielder; coarse in appearance.

Conqueror.—Pointed leaf; grows long distances apart on stalk; matures early. Should be 3ft. apart.

Granville Yellow.—Rather delicate; matured late; suffered during dry weather. Should be 3ft. apart.

Hyco.—Suffered from drought; nice broad leaf; light yielder.

CIGAR VARIETIES.

Sumatra.—Tall growth; delicate light yielder; small leaf. Can be planted 3ft. apart.

Comstock Spanish.—Large narrow leaf; matures early; light yield; liable to soon spot; coarse texture.

Connecticut Seed Leaf.—Strong grower; large leaf; nice texture; heavy yield. Should be 3ft. 6in. apart.

Mr. Smith continues: "The experiments of the year go to show that some of the best varieties can be successfully grown, and the distribution of seed of such varieties must have a beneficial effect on the future production of tobacco in the district. The area of the past year's crop was double that of the previous year, and growers are arranging for a still larger next season."

An experiment of growing cigar leaf varieties under a tent made of cheesecloth gave satisfactory results, the texture being much finer than the same varieties grown in the field.

Correspondence, Reports, Etc.

The correspondence during the year was very heavy, the result principally of the great developments in the field work, and the

numerous inquiries sent in by farmers concerning the manurial and cultural requirements of crops, the treatment of soils, the value of foodstuffs, and other matters in connection with farm practice. Much of the success of the operations of the branch for the past year depended upon the untiring industry of the clerical staff, and I have to thank Messrs. Hatton and Hasset for the long hours of overtime willingly given in the interests of the branch without the slightest remuneration.

The total outward papers numbered 7,174, and were made up as follows:—

Letters and Reports press copied	2,712
Circular letters in connection with experimental Field Work	2,930
Other circular letters, statements, etc.	912
Accounts checked, entered and passed	620

In addition to this, numerous reports of a lengthy nature dealing with the results of the field work were distributed to agricultural societies and farmers.

REPORT OF THE BACTERIOLOGIST AND SCIENTIFIC INSTRUCTOR IN DAIRYING.

T. Cherry, M.D., M.S.

In reviewing the work of the past year, the most important circumstance has been the drought, which has affected the whole State and brought dairying in the Northern districts almost to a standstill. In consequence of these unusual conditions I thought it best to devote most of my lectures to the question of fodder for the dairy herd. In explaining the fundamental principles of food and feeding, the main point is to insist on the all important distinction between the flesh forming and heat producing constituents of the food. Under ordinary circumstances the latter, represented chiefly by sugar in its various forms, can be abundantly raised on every farm, but with the flesh formers the case is entirely different. The value of grain and its products, of peas and tares as green fodder, and above all of lucerne cannot be too much insisted on. In Europe and America the supply is largely supplemented by a variety of concentrated foodstuffs, but with us these are not used to any great extent, and consequently the practice of raising crops rich in nitrogen on the farm, to help out the natural grasses, must be looked upon as a most important step towards placing dairying on a permanent footing. Efforts have also been made to induce the northern farmers to preserve and cultivate the saltbushes, another most valuable plant in dry districts.

Another fact, which the drought has brought home in a way never before realised, is the necessity for a certain amount of succulent food in the daily ration of the cow. Too often the fundamental differences in the digestive system and requirements of the cow and the horse have been overlooked. By systematic growing of fodder crops, the necessary green food can be raised in all the Southern districts, but where the rainfall is deficient, the easiest and most satisfactory method is by means of silage. Unfortunately the early attempts at making silage in Victoria have not been too successful and many farmers who have tried it have given it up. The conditions necessary to insure uniform success have been worked out in America during the past ten years, and the modern overground silo is the result. Briefly, the most important point is found to be the complete exclusion of the air, and this can best be secured by passing the green crop through the chaff cutter or similar machine before filling it into the silo. Besides using a model of such a silo to illustrate my lectures, the Department has had one capable of holding 65 tons erected at the Royal Agricultural Show, and it is satisfactory to note that several farmers have already had similar silos built, and speak of the quality of the silage in the highest terms. A number of analyses of samples of such ensilage are now being carried out at the laboratory of the Chemist for Agriculture.

Along with the question of fodder crops the allied subject of shelter during the cold months has also received attention. The practice of rugging is now very generally adopted, but the growth of fodder *rich in the flesh formers* can be most satisfactorily carried on by the help of farmyard manure. Housing the herd therefore becomes increasingly important with the development of improved methods of dairying.

Lectures on the above lines, but modified to suit local conditions have been delivered as under:—

Bacchus Marsh (2)	Romsey	Myrtleford
Beech Forest	Bealiba	Milawa
Geelong	Murphy's Creek	Whitfield
Colac	Boort (2)	Korumburra
Eurack	Charlton	Kongwak
Terang	Echuca	Poowong
Cobden	Heathcote	Loch
Framlingham	Kilmore	Leongatha
Woodford	Tatura	Yarram
Warrnambool	Shepparton	Pakenham
Garvoc	Ardmona	Fern Tree Gully
Koroit	Seymour	Warragul
Wando Vale	Longwood	Lardners
Condah	Euroa	Sea View
Melbourne (2)	Balmattum	Bloomfield (2)
Brunswick	Sheen's Creek	Trafalgar
Toolern	Gooram	Moe
Ballan	Strathbogie	Hillend
Ballarat	Benalla	Morwell
Clunes	Wangaratta	Narracan
Horsham	Wangaratta North	Traralgon
Walmer	Springhurst	Maffra
Warracknabeal	Barnawartha	Boisdale
Nhill (2)	Wodonga	

Food Preservatives.

The announcement, which has just been made by cable, of the results of the experiments conducted by Professor Wiley on the effect of boracic acid and other preservatives in food, cannot fail to have most far reaching results. These experiments have been carried out on healthy men on a scale and with precautions which have never before been attempted. Hitherto the effects of the continual consumption of small quantities of food preservaties have chiefly been deduced from the results of experiments on animals. Professor Wiley's results are apparently altogether unfavourable to the use of preservatives, as it is found that their use inteferes with the due repair of of the living tissues. Should these experiments be confirmed, the laws relating to the use of preservatives in food will probably be speedily altered so as to practically prohibit their use. Victorian butter factories should therefore make preparations to be independent of them, and, provided the milk or cream is delivered clean and fresh

there is no question that they may be dispensed with. What are the precise conditions under which butter can be profitably sent to London without preservatives, and whether pasteurisation is essential or not, are points on which further investigations are required. From experiments conducted at the University Laboratory we have ascertained that the two chief factors are the number of organisms present of varieties other than the lactic acid bacteria, and the amount of butter-milk and curd left in the butter. Pasteurisation and the use of pure cultures of lactic acid organisms as starters are important means towards attaining this object. Last season little butter was exported to London, and most factories gave over pasteurisation, but with the return of normal conditions there is no doubt that it will be much more extensively adopted than ever before.

Educational Work.

The educational work of the year has been chiefly devoted to laboratory courses for factory and creamery managers. The object of these courses is to make the manager practically acquainted with the essential changes underlying fermentation and putrefaction. Every afternoon for a fortnight is spent in working out the chief details of bacteriology as applied to the dairying industries, the microscopes and all apparatus being supplied by the Department. The following classes have been held :—

1902	University, Melbourne ...	Attendance	18
„	„ „ ...	„	16
1903	Euroa	„	18
„	Kyneton	„	6
„	Koroit	„	7
„	Terang	„	8

It seems likely that the best attendance at country centres will be secured in cases of factories having a large number of creameries attached.

Lectures were also delivered in connection with the short courses in agriculture at the following schools :—

Tatura.	Boort.
Bacchus Marsh.	Warrnambool.
Charlton.	Maffra.

Bacteriological Investigations.

The investigations carried out at the University Laboratory during the year have covered the following branches :—*a*. The preparations of vaccines and antitoxins.—In relation to pleuro-pneumonia in cattle it is found that the micro-organism which causes the disease is so small that it passes through some of the so-called "germ-proof" filters. By experimenting with Berkefeld filters a "candle" was obtained which allowed the organism of this disease to pass through, but intercepted all the adventitious organisms that were present in the fluid.

The clear fluid from the cavities of the chest of an animal dead of the disease, when thus filtered constitutes a means of reproducing the disease in animals for protective purposes. Comparison of the temperature charts show that the disease runs the normal course, and there is no doubt that this "purified virus" will avoid the risks of septic complications which sometimes cause the death of the animal when inoculation is performed in the usual way. Investigations have also been carried on in relation to protective inoculation against anthrax, but these are not yet complete.

b. A disease which causes great mortality amongst bees is being investigated. I am inclined to think that it is due to a deficiency of proper food during the larval stage It is at this period in the life of an insect that all the active living tissues are built up. In the adult stage the food is used to supply energy, but there is little done in the way of the renewal of the worn out tissues comparable to what obtains in the higher animals ; hence a deficiency in the nitrogen of the food of the larva is likely to result in malnutrition and permanent loss of vitality. Analysis of the different samples of pollen shows that considerable variations occur in the amount of nitrogen present but it will take some time before a sufficient number of samples, the history of which is known, can be obtained to settle the point definitely one way or the other.

c. About 3,000 tubes of locust fungus have been supplied to the Entomologist.

d. The routine diagnosis of specimens for the Stock Branch has continued during the year.

e. Samples of water, milk and butter have been examined for bacterial contamination, and pure cultures of lactic acid bacteria supplied to 14 factories.

The work of the laboratory has been carried out in a most satisfactory manner by Dr. Bull and Dr. Cowan.

REPORT OF THE DAIRY EXPERT AND MANAGER OF GOVERNMENT COOL STORES.

R. Crowe.

The Export Trade in Perishable Products.

When I was a boy in the eighties, I remember prime legs of mutton being delivered at the door for 1s., 9d., and sometimes 6d. each. There was then no outlet for our surplus production in mutton, except through the boiling down establishments and the export of tallow. Butter was at times almost unsaleable, and was often disposed of for 3d. per lb., after the spring and summer supplies had been kept for nearly twelve months. Cheese and other perishable commodities were also subject to like uncertain market conditions. I have a vivid recollection of assisting my father in the sowing and cultivation of two paddocks of potatoes, consisting of 20 and 25 acres respectively. The rent per acre was 30s., the value of the seed was 20s., the land had been ploughed twice before planting, the crop received the usual scarifying, drill-harrowing, hand hoeings, and hilling up, the cost of which amounted to another 30s. per acre, or a total outlay of £180, and, although the yield exceeded 5 tons to the acre, he realised the magnificent sum of £45 sterling, or £1 per acre. Biennially, or every third year at most, many pigs were ruthlessly slaughtered in order to secure payable prices for growing and fattening the remainder. From this it will be seen that the prospects of the producer in those days were very precarious indeed. No wonder the farmers' sons left the country to obtain positions in the city as civil servants, clerks, or tram conductors. Good agricultural land was at a minimum, and the life of the average farmer was simply one monotonous round of drudgery from daylight to dark. The task of raising from the soil sufficient for our limited population was a comparatively easy matter, and when that requirement was exceeded prices fell to a level which would at times not permit of both ends being met, to say nothing at all of a profit. It will, therefore, be seen how imperative was the necessity, to adopt methods, which would enable our surplus perishable products to reach outside markets. We can well understand the satisfaction felt both here and abroad at the successful landing of the first consignment of frozen mutton in England in good condition early in 1880.

All honour is due to the noble pioneers and inventors of refrigerating machinery, and in this connection we should on no account forget the valuable work contributed by the late Dr. James Harrison, of Geelong. He devoted the best part of his life to it, and succeeded in placing artificial refrigeration upon a footing that led to its ultimate adoption in the transportation of perishable products. His work has since won world-wide recognition. An everlasting debt of gratitude is also due to the late Mr. T. S. Mort, who spent about a quarter of a million sterling in endeavouring to successfully establish the frozen

meat trade. His long continued labours in this direction were so unselfish and far reaching, as to entitle him to be ranked by posterity as a great national benefactor. For eight years after the first successful shipment, meat was our only perishable export. The first consignment totalled 400 carcases of mutton and lamb, while last year over 400,000 carcases left Victoria. During the last eleven years, Great Britain has paid us about two and a half millions sterling for frozen meat. Recently more attention has been devoted to breeding a special class of lamb and mutton to suit British requirements, and the method of management adopted by breeders is also being rapidly shaped towards the same end. Special provision, so successfully adopted in other countries, has hitherto not been made here for topping off lambs and sheep for freezing. A very satisfactory stage has been reached in New Zealand, where the volume of lamb and mutton export has completely overshadowed ours. This is largely due to their making a specialty of the growing of turnips, rape, and other fodder. Special efforts are needed in this direction in Victoria, in order to enable her to compete against rivals in the world's markets, and to rapidly and successfully develop the industry, and we should lose no time in emulating the example of New Zealand.

Butter.

And now a word or two about butter. During the last thirteen years, which covers the whole history of the export trade in butter, over £10,500,000 sterling has been paid to Victoria for her exported surplus. Our exports were nearly doubled during each succeeding year until the season 1894-5 was reached; but, owing to the four years' drought—from 1895 to 1899—they receded instead of showing an expansion. The elasticity and vitality of the industry are demonstrated by the fact that during the two following years our best records were achieved, only to be dashed again through the terrible drought of the last two years, from which we are now happily emerging. Among the lessons of this experience, indelibly imprinted on every dairyman's memory, the most important is the conservation of fodder. As a large section of our dairymen are now taking precautions, it is likely that similar disastrous results will not recur. Unfortunately, the losses already entailed are not to be gauged by the shortage in production only, for markets are left unsupplied, and business connections severed, to be eagerly acquired by our competitors. There is every indication of next season proving one of the best this State has ever had. But the stronghold so hardly won in former years we have been obliged to abandon, and commence the attack anew. Our competitors in the meantime have been afforded the opportunity to entrench themselves and strengthen their defences. The drought has smitten our industry so much that during the last two seasons the Argentine and New Zealand have effected for themselves a firm lodgment both in the South African and British markets at our own season of the year. We have, too, to encounter a most formidable competitor in Siberia, and those who have followed recent events in Manchuria need not be told that the Russian bear does not easily

relax his all-crushing grip upon anything he once lays hold of. Who can tell how far this element has conduced to the precipitation of Mr. Chamberlain's policy of Preferential Trade? His words have echoed and re-echoed throughout the length and breadth of the world, for it is the first announcement of what is recognised as the warfare of the future, when the world will witness battles of a purely commercial rather than a military nature. As in martial manœuvres, so in the tactics of commerce. If the army of our export trade be loyal, well organized, drilled and equipped, all opposition must be vanquished. We have a soil proved to be eminently adapted for dairying, and a splendid climate. With effective conservation and use of our water supply, the rest should be easy. No time should be lost in preparing for the coming season, by brushing down, cleansing, and whitewashing our butter factories, creameries, and dairy buildings, and getting our plant and machinery into satisfactory working order. Quite recently our first shipment of butter was sent away, and in the course of another few weeks the whole accumulation from last season's unfortunate speculative ventures will have disappeared. The new season will then be upon us, and the indications from all portions of the State warrant the anticipation of a prolific innings. One of our most necessary requirements will be the proper care and treatment of cream from home separators. Drastic, I might almost say revolutionary, measures must be taken to remedy the general abuse of this system, which has done so much to lower the standard of our butter. Where home separators are absent, the product is invariably on a high plane of excellence. If all cream, wherever possible, were delivered daily to the nearest factory from October until the end of the shipping season, immediate and substantial improvement would be effected. Factory managers and directors already realise this, and it is to be hoped that an understanding will be reached at the Conference to be held between the Dairymens' and Factory Managers' Associations this month. I have been frequently charged with a prejudice against home separators, and must confess to a deep-rooted aversion to their use in any place where local co-operation is possible. In the proper care of cream, mechanical refrigeration is an absolute necessity. The individual can rarely avail himself of this assistance, but when large quantities are operated upon its use falls lightly on all. My objection is based on the general inferiority of the home separator butter presented for export for the last seven years as compared with that from other sources. I know of considerable quantities of very good butter from some home separators where the collection of cream has been well organized and attended to; but, speaking generally, the character of such butter will bear much improvement. Do not let me be misunderstood; I do not condemn the use, but the abuse, of the home separator, without which, I admit, dairying in isolated or mountainous districts, or in localities where the combined treatment of milk is impracticable, would be impossible. I have on every possible occasion assisted home separator people, but the task of attending to over 6,000 users in Victoria is an altogether hopeless one with our limited staff of instructors

Instruction in Butter and Cheese Making.

Mr. Archer, Government Dairy Supervisor, has handed to me the following account of his work during the year :—

In connection with my duties as Dairy Supervisor, I have visited, inspected and given instruction to the managers of 42 butter factories and 15 creameries, many of which I have visited several times. I have also visited 83 farms for the purpose of giving instruction in the treatment of milk and cream, the feeding and management of stock, etc., also to advise and assist the Municipal Dairy Inspectors in the performance of their duties. In February last I received instructions to devote my attention to the improvement of the present methods of cheese making, and I have visited 19 cheese factories, at many of which I have stayed a fortnight giving instruction to the cheese-makers, and in almost every case with very gratifying results. In every instance I have been well received and generally find people eager to receive instruction.

I have attended at five Agricultural shows for the purpose of testing the milk in connection with the milking competitions and for giving information to farmers, and at five meetings in connection with the commencement of co-operative butter or cheese factories. I have delivered seven lectures and papers to farmers and butter and cheese factory managers, besides contributing articles to the *Journal* of the Department of Agriculture.

Mr. Carroll, Dairy Supervisor, reports as follows :—

During the year I visited and inspected 502 dairy farms, 45 factories and 25 creameries, and also attended at the Melbourne Show, and nine country shows, at which milking contests were supervised and tests conducted.

Where a proper system of dairy inspection has been instituted, a distinct improvement is noticeable in the cleanliness of cow-yards, dairies, milk store-rooms and utensils. This opinion is fortified by managers of butter factories in those localities. Unfortunately, however, in some cases at least, the appointment of dairy inspector is only nominal, the salary paid not being sufficient to enable a thorough inspection to be made, and the support in some instances extended by the Council is very meagre. There are a few shires where inspection has been postponed owing to the drought, and others again where no attempt at dairying inspection is made, and the dairy farmers residing therein are antagonistic and have no sympathy for dairy inspectors or inspection. As a consequence of this antagonism, I found it difficult to get an opportunity of imparting instruction or giving advice of any kind.

For the benefit of the industry in general, I would advise that inspection be made universal, thereby securing a uniform system of inspection, and a raising of the standard of the milk supply.

By a personal inspection of the farms, I was enabled to afford assistance and give advice in the breeding and selection of suitable stock, manner of feeding, the growing of summer fodders, cleaning of dairy utensils, and other details of the dairy, as well as rearing of calves. Much good has been done in this direction, but owing to the large district over which I have to travel, it is impossible for me to visit every farm.

I have had occasion to visit several butter factories at the invitation of the factory manager, or by direction of Mr. Crowe, to investigate the faults found in butter coming in for export, and to assist in rectifying same, give instruction in testing, making of pure cultures, and advice as to sanitation.

By request, I attended meetings of boards of directors, and discussed the necessity for re-building and equipping their factories with more powerful and up-to-date machinery. A number of these factories were built and equipped, as was then thought, to meet requirements, but the estimate has been largely exceeded, and many of them have outgrown their usefulness. I am pleased to state that my efforts in this direction have been rewarded, new and improved machinery having been put in, new buildings erected, and alterations made to old buildings on my recommendation.

A portion of my time has been taken up in investigating and setting right disputes and misunderstandings which arose from time to time, between milk suppliers, directors and factory managers, thereby helping to secure a more friendly feeling between dairymen and companies.

Mr. Wilson, Assistant Dairy Expert, reports having inspected 1,287 consignments of butter for export beyond Australia, and in-

spected three butter factories in the country during the year in addition to assisting generally at the Cool Stores.

From those reports it will be seen that 44 per cent. of the butter and cheese factories, 10 per cent. of the creameries, and less than 2 per cent. of the dairy farms have been visited, and instruction given.

In addition, I gave 12 lectures and wrote 1,463 letters and reports, giving advice to dairymen and factory managers. Almost every day producers called for information on dairy subjects, as well as matters relating to the export trade.

Statistics appearing in another part of the *Journal* shew the volume of business transacted at the Government Cool Stores, and in connection with the export of perishable products. From a trading point of view, the result of our operations must be considered satisfactory, especially when it is recognised that the season for certain branches was a very short one. During the first four and a half months scarcely anything was done, and the rent alone runs into £300 a week. The railway strike, and the subsequent train service, also materially affected our turnover in the rabbits. Notwithstanding the bad start made, the restrictions experienced, and the high rent, etc., to be met, the whole business shows a trifling loss of only a few hundred pounds.

The Grading of Butter.

The voluntary grading of butter for export, which will be very largely availed of this coming season, will do much to restrict all phases of abuse in connection with the deterioration of butter prior to export. Many factories have already signified their intention to accept the offer made by Mr. Wallace last year that all who requested the Department to grade their product prior to shipment would have their wishes complied with. Grading for export is a national requirement to-day. Every year sees the recognition of this principle by one exporting country or another. In New Zealand the success that has attended the introduction of grading is phenomenal. Prior to its adoption she held an indifferent position both as regards quality and her system of doing business. Her butter was shipped on consignment and this, coupled with the fact that some brands were defective, weakened her position. With the adoption of grading, however, defects were not only immediately made apparent but driven home to the manufacturers, and managers were obliged to effect improvements. In this way the quality was levered upwards and a forward business rendered possible. By a forward business I mean that people can buy to arrive for months and, if they please, years ahead. This will be possible for firms who have only business representatives in the country without the technical knowledge of all the details imperative under other circumstances. What has been the result? For next season, between two-thirds and three-fourths of New Zealand's output has already been bought on grade in England. The buyers have the protection of the Government classification, and being

directly interested in the product at high figures, it is incumbent upon them to maintain the standard. With full supplies then they have to see that a sufficient number of customers are secured to keep up the price. She has, therefore, a well organised army, finding customers for every box to arrive. It will be seen, therefore, that New Zealand's clientele is much more extensive in consequence of her grading system and is not confined merely to a few. In the absence of grading only a consignment business is usually done. It is too much to hope that values in Great Britain will remain at the same high level as have been experienced for the last four years. We must encounter a declining market after the abnormal demand during the period of the late war. Grading will enable us to command a far wider range of purchasers, who would buy on grade alone a large section of our output to arrive. In this way we would reap direct advantages. The makers of our best butter may say that they have nothing to gain by grading, that the appearance on their boxes of the Government stamp, "Approved for export, 1st Grade," will not help them in any way, but their individuality will in no way be obliterated, and they will thus be enabled to leave inferior brands in their proper place. An incentive to improve would be thus forced upon the makers of an inferior article. I know that this has been a very much debated question, but having watched closely the course of events in all parts of the world for the last seven years, I am thoroughly convinced that it will be vastly to the benefit of our industry to have the whole of our butter graded. This matter was before Parliament until recently and therefore a political subject, but now that the Minister of Agriculture has approved of voluntary grading, I feel free to give it my earnest advocacy. It will materially help us in regaining markets which we have recently been obliged to abandon through shortage in production, as I have already pointed out.

Cheese.

With the manufacture of cheese, gradual and satisfactory headway is being made. Federation has given a substantial fillip to its extension, and since Victoria is most favoured for its production the bulk of the Commonwealth's requirements will certainly come from this State. Half-a-dozen new factories have been established within the last year, and our esteemed Director of Agriculture is alive to the necessity of assisting in raising the standard of our output. Mr. Archer, of the Department, has been pursuing the coat-off system of teaching for the last few months, and has already done much towards raising the quality. The new method of maturing cheese at low temperatures will also increase the profits of our dairymen. Some time ago, I indicated the advantages of this system, and our experience has since been in the direction of confirming what has previously been reported. It is hardly likely, however, that Victoria will find it to her advantage to cater largely for the London market with cheese, because it is not so concentrated a product of milk as butter. The charges for railage, handling and ocean freight, are the same per lb. as in the case of butter, therefore to market in London every pound of cheese would cost twice as much as a corresponding value of

butter. So the supply for London will continue to be held by Canada, and countries more within reach than ourselves. But there is room both in the Inter-State, South African and Eastern markets for a very considerable expansion of our cheese export trade.

Milk and Cream.

It is satisfactory to know that, although Victoria is a new country, and has not had the advantage of an established reputation for the quality of its concentrated milk and cream, it has already practically secured the whole of the Ocean shipping trade calling at Melbourne. In addition to this the South African connection is being extended every year, and large contracts have been secured from the United States Government for the supply to the military authorities in the Philippine Islands, while some is now sent even to London. Reference to this achievement is sufficient to indicate its superior quality, and no doubt as a branch of our dairying industry the business will assume large proportions.

Pork.

The supply of pork in Victoria has about reached the point of exportation. Last year's experience will stand out for all time as a reflection on our producers, because whatever effect the drought has had on meat and grain, they should have been equal to catering for the supply of pork, as it did not so prejudicially hamper the pig raising localities of the State. Within the last few months a total of 32,000 carcases of frozen pork were imported into Australia from America, some of which were brought to Victoria, but to our credit be it said it has been adjudged by competent authorities as being much inferior to our own. As far as uniformity and get-up are concerned nothing better could be desired, but it was purely in regard to the quality that it proved to be deficient. The breed of pigs in Victoria now-a-days would be very hard to beat. The Berkshire fulfils every requirement, and the only thing wanting is for our people to breed and fatten more. With a profitable export outlet there is no danger whatever of over production. Last year 3,416,111 lbs. of bacon and ham, frozen and salted pork were exported. Notwithstanding the drought, this was 600,000 lbs. more than the total for the year before. Customers abroad for our bacon and ham are daily increasing, the quantity sent to Africa is also being added to every month, and we should in every way endeavour to develop this connection.

Poultry and Eggs.

The export of poultry, which was growing so rapidly, has, in sympathy with all other products, temporarily sustained a severe check through the drought. Our ante-drought successes, however, can be accepted as a certain indication of the possibility of an immense expansion. Victoria, owing to her great wheat growing areas in the Goulburn Valley, the Mallee, and the Wimmera, not to mention her extensive orchards, is admirably adapted for poultry raising, which should ultimately rival our exports in rabbits. And

here again, the careful preparation and grading of the goods for market is absolutely essential. Unfortunately, much of our exported poultry is not graded. When laxity is permitted in regard to age and quality, orders are bound to be discontinued, and the only way to get on a solid basis is by establishing supervision and grading.

We have not as yet found it necessary to export eggs in quantity, because production has not much more than equalled the requirements of our own population. However, when the stage of exportation is reached, our past experience will stand us in good stead. The great success which has attended our past few years' storing experience in securing for consumers fresh eggs in abundance the year round, and to the producer much higher prices, shows that it is only a matter of a short time now when the possibilities and bounds of this feature of the trade will be reached. When that is so, we must export all the surplus to outside markets. The Department has demonstrated that deterioration may be completely arrested for an indefinite period by means of cold storage, so that there can be no danger of glutting the market by over production.

Rabbits.

It will probably surprise many to know that the weight of the six millions and odd frozen rabbits exported last year was equal to that of 300,000 carcases of mutton of average size. The rabbits exist here, and their recognition as a factor in the export trade, while conducing to their eradication, provides employment for thousands of trappers and others, and helps to gratify the palates of those at home who are only too willing to pay high prices for them. The soundness of this trade is in a large measure due to our system of grading. All rabbits exported from this State are classified under Government supervision, and each and every rabbit is carefully handled by an experienced Government grader, and sorted into one of the half dozen classes adopted. They are put up as "large" weighing 2½ lbs. and over, "young" 2 lbs. and over, and "small" 1½ lbs. and over This comprises the best grades, and all brands on the packages are black in colour. In addition, a second grade is employed with the following designations, "size 1," "size 2," "size 3," weighing respectively over 60 lbs,, 48 lbs., and 36 lbs. net, per crate. The second grade brands are all red in colour. Rabbits unsuitable for export are rejected, and, if unfit for human consumption, condemned, phenyled, and sent to the desiccators to be manufactured into manure. Here we have a striking illustration of the value of grading, under which our rabbits realise 2s. per crate more than those shipped from New Zealand. The system has secured the confidence of buyers abroad. New Zealand rabbits are much better conditioned and furred, but owing to the absence of grading and Government supervision bring less than ours in the English market. We have in operation, in connection with rabbits, a complete organisation for coping with one hundred times the work that would be necessary in regard to butter, for the reason that fully 8,000,000 rabbits have to be handled individually, whilst with 10,000 tons of

butter a 10 per cent. examination would suffice. This renders future business possible, and some packers have sold their supplies for the next 12 months to come. Although this system is voluntary, not a single rabbit is exported from Victoria which has not been graded by a Government officer. At outside freezing works we have graders who are wholly under the control and direction of the Government. Every Monday morning full particulars are secured by me of rabbits received each day for the previous week at all works throughout the State, showing the proportion passed as "large," "young," or "small," etc., as well as the number rejected and condemned. In addition, weights of grades packed each day are sent. In this way we have a comparison between what is done at outside freezing works and by our graders. In order to complete the check of every grader's work, a certificate is placed in each crate, and purchasers are requested to return it to the Department if the goods do not answer the description, together with the defect fully described. This is what has secured the confidence of buyers, so rapidly developed the industry, and raised the value of our goods.

Fruit.

Fresh fruit is bound to figure amongst the perishable exports of the future. The experience of the last three years has affirmed the desirability of cooling prior to shipment. The irregularity in condition of some of our shipments on arrival in London is due principally to putting on board consignments at temperatures ranging up to 60 and 70 degrees. In order to cool these large bodies of fruit at so high a temperature, a cold blast below freezing point was turned on with the result that, where the frigid current struck, it became frozen, the necessity for which could have been avoided had it been gradually cooled before shipment. When fruit is placed on board without being previously chilled, the officers are face to face with two very serious difficulties, on the one hand is the danger of freezing portion of the consignment in order to land the bulk in the best condition, and, on the other, shrinkage and over ripeness through insufficient cooling.

A total of 60,000 cases was exported from Victoria to Great Britain last year, 15,000 of which were packed and cooled at the Government Cool Stores. Already space in these chambers has been bespoken for over 60,000 cases for next season. The cooling of fruit will enable lower freights to be secured, and furnish more satisfactory results.

Supplementary Industries.

Reference to the export trade would be incomplete without, at any rate, casual mention of the many subsidiary industries that are called into play, prominent among which are saw-milling, box-making, the manufacture of cotton goods, and printing. Half-a-dozen timber factories, employing hundreds of men in making butter boxes, rabbit crates, and fruit cases, are kept going nearly all the year round. Two large factories are in full swing at wrap-making for mutton,

beef, veal, pork, etc., all of which wraps are printed with the necessary shipping brands and marks.

SUMMARY.

We have already reached and established business connections with Rangoon, Singapore, Samarang, Sourabaya, Colombo, Shanghai, Hong Kong, Thursday Island, Cape Town, Durban, Port Elizabeth, Natal, Manila, St. Helena, St. Denis, Majunga, Diego Suarez, Bombay, Calcutta, Batavia, Tsien-Tsien, Port Said, Penang, Beira, Madras, Alexandra, Aden, Java, Mauritius, Bangkok, Delagoa Bay, Chemulpo, Tsingtan, Nagasaki, Saigon, Haipho, in addition to the well known Inter-State, United Kingdom, German and French ports. It will thus be seen that, as well as catering for the requirements of our cousins in neighbouring States, South Africa, and the United Kingdom, we assist in supplying the Germans, French and Spaniards, Japanese, Indians, Chinese, Philippinos, Javanese, Egyptians, Maltese, Greeks and others. The export of frozen products has already exceeded £15,500,000 sterling, made up of 10½ millions for butter, ¼ of a million for cheese, milk and cream, 2½ millions for meat, 1 million for rabbits and hares, and nearly 1¼ millions for fruit.

This is an achievement that we have reason to be proud of. With the return of normal seasons our minimum should not be less than £2,000,000 annually. Yes! It is wonderful. But how insignificant when we realise that Great Britain paid £85,586,906 last year for imported perishable products, 20½ millions of this was for butter, 6½ millions for cheese and milk, 6¼ millions for eggs, 9¼ millions for fresh fruit, 23 millions for ham and bacon, pork and lard, 19 millions for meat including salt and preserved meat, and three-quarters of a million for rabbits. Although the principal market catered for, it is one in which we have not as yet gained much recognition. What an immense field it opens to our producers! What encouragement for our rural industries! What a difference now as compared with only 15 years ago!

No stone should be left unturned in order to maintain and improve our position as growers and exporters of reliable products. The direction in which improvement can be made I have endeavored to indicate and the rest largely depends upon the individual and combined efforts of all rural producers.

REPORT OF THE VITICULTURAL EXPERT.

G. H. Adcock, F.L.S.

I have the honor to furnish my report on the work of the Viticultural Branch for the past year.

Up till the 31st of January last, this branch was controlled by Mr. R. Dubois, B.Sc., F.C.S., whose removal to assume the important position of Viticultural Expert to the Government of Cape Colony has been a distinct loss to Victoria. The introduction of American vines, the establishment of experimental stations, the translation and dissemination of standard viticultural literature, and the present excellent arrangements at the Rutherglen Viticultural Station are, among other items, permanent records of Mr. Dubois' work in Victoria.

Mr. L. Pilloud, the Inspector formerly in charge of the Bendigo district, was transferred to the Vegetation Diseases' Branch during the current year.

The check in the extension of Victorian vineyards referred to in the last annual report has not been overcome, and, unfortunately, the industry is not in so flourishing a condition as it should be. We are at a critical period in matters viticultural. The invasion and extension of phylloxera have disheartened many of the growers whose vineyards are being devastated by this tiny but formidable pest. It is at this juncture, if at any time, that the value to the community of this branch should be made apparent, and, in my opinion, all the resources at the command of the Department should be fully utilised to assist in restoring the prosperity of the industry, for which, it goes without saying, there are unlimited possibilities in this State. If we no not wish to pay too dearly for our reconstitution experience, it is important that we do not procrastinate.

Rutherglen.

The distribution of American vines was continued last winter, when 92,277 were sent out to various growers. The following are the numbers and kinds :—

Solonis	300
Rupestris mixed	2,412
Riparia, ,, ...	300
Hybrid, No. 101-14	800
,, ,, 3,309	9,420
,, ,, 3,306	14,663
Riparia gloire	9,650
,, grand glabre	22,130
,, portalis	2,740
Rupestris Ganzin..	4,330
,, Martin No. 1	4,215
,, ,, No. 2	5,585
,, du Lot	8,192
,, metallica (Cape)	7,540
	92,277

Of these 82,313 were cuttings, and 9,964 were rootlings. This makes a total, distributed free of cost during the past three years, of 356,579. In other States, for example, New South Wales, New Zealand and Cape Colony, the cuttings are sold by the various Departments, and the sum received considerably reduces the cost of growth. This practice has now been adopted here, 10s. per 1,000 being charged for cuttings, and 20s. for rootlings. The majority of recipients have tended the vines with the greatest possible care. In many cases they have made exceptional growth; in other instances, notwithstanding the care bestowed on them, and owing to the severe and protracted drought, the American vines supplied have not been a success.

It is also doubtful whether more than a few vignerons will be able to cope with the grafting successfully. It is to them a problem of more than ordinary difficulty. The low percentage of strike is disheartening, and in several instances the vines are already being abandoned. Personally, I think it would be wiser policy on the part of the Department to discontinue sending out stocks as such, and graft as large a quantity as available with suitable European varieties, and, after rooting them, sell them at as low a rate as possible to the growers.

Phylloxera is slowly, but none the less surely, spreading, and is yearly throwing certain areas out of production in this State. Unless we can have our area and production kept up by reconstitution, the industry must continue to languish.

Many growers were induced by means of a bonus to plant vineyards. The introduction of American vines was delayed for nearly a quarter of a century after the ravages of phylloxera commenced. It would be well worth while for the Government to step in at this crisis and supply *bona-fide* vignerons, whose vines are infected, with grafted resistant stocks at a nominal price, and thus subsidise and save an important but declining industry.

Our experimental vineyard here is being established under such conditions as will render it a striking object lesson. Let the grower see some definite and permanent results and his very natural trepidation will vanish. Though we are now passing through such a crisis as all European viticultural countries have had in turn, we shall with care come out all right in the end as they have done.

The resistant vine nurseries have been completed. About 9 acres were carefully planted and trellised for the growth of "wood," of which we shall in future have an abundant supply. To secure absolute accuracy in the names, Mr. Dubois went over every plant with the greatest care, so that we can rely on their now being "true to name."

The experimental work has been continued here on the lines mapped out by Mr. Dubois. To Mr. Wyatt's assiduous and indefatigable attention the high state of efficiency exhibited is due, notwithstanding considerable reductions in the staff, owing to retrenchment. His efforts have been ably supplemented by Mr. Coleman,

who is not only a zealous worker during official hours, but, like Mr. Wyatt, devotes a very considerable portion of his leisure to the work of the station.

Last year the grapes grown in the vineyard were sold to a local vigneron, but this season Mr. Wyatt converted them into wine, which promises exceeding well. The wines made are of the following types: Claret, Burgundy, Hock, and Riesling; and the total quantity made will be about 3,500 gallons.

Phylloxera at the Head Station.

The unfortunate discovery that phylloxera had invaded the vineyard attached to the station was made by Mr. Dubois some time before his departure. The infected portion was promptly treated with carbon bi-sulphide to destroy the vines, and as many of the insects as possible, in accordance with the data obtained during our experiments in 1900. This part of the vineyard has been uprooted, the land thoroughly and deeply subsoiled, and is now being planted with grafted American vines. It should thus afford a practical test of the efficacy of resistant stocks. Since the discovery of phylloxera at our Rutherglen Head Station, a considerable amount of apprehension exists regarding the probability of the pest being introduced into other districts by means of cuttings, etc. It may be noted, however, that the infection was in the part of the European vines most remote from the nurseries, and the same implements were never used in cultivation. Under instructions, early in the year, I submitted a comprehensive report on this question, as well as on the methods to be adopted to check the spread of the insect. In future no cuttings will be sent out to clean districts, and all cuttings will be treated before despatch to any other parts. The most effective method of treating cuttings is to expose them to the fumes of carbon bi-sulphide in an air-tight compartment, as a box or vat. That it does not injure the cuttings is shown from the fact, that those kept for a prolonged time in an atmosphere charged to saturation with these fumes had their vitality in no way impaired. The eggs, if any, (and these are our chief fear on cuttings), are destroyed by this treatment. The canes, when treated, should be a little longer than actually required for cuttings, and then the exposed ends may be removed before planting. The carbon bi-sulphide must be placed in wide, open, shallow vessels on a shelf *above* the cuttings in the air-tight compartment. This is owing to the specific gravity of the chemical, none of which should touch the canes. Treatment with hydrocyanic acid gas, as for scale insects, etc., on citrus trees and fruits, would, where it could be conviently applied, also prove effective.

Grafting Operations.

The grafting was conducted here last season on a fairly large scale. It had never been so extensively attempted in Australia previously. The operation is now in full swing, but, owing to reductions in the staff, this work has not proceeded as quickly as desired. The

grafting is done both by hand and machines, the latter proving, if anything, the more successful. The tongue of the hand-made graft being small is apt in growing to push the scion out. The raffia was found to be affected with some fungus, and was treated with bluestone before use. We have all the appliances for grafting, callusing, and growing these vines, and to this work in future considerable attention must necessarily be paid. The grafts made last season knitted well, making splendid unions. Practically all callused, not more than 1 per 1,000 failed, but the excessive drought that killed out entirely a large number of the American vine plantations in the district, proved, in the absence of a water supply, disastrous to many of the grafted cuttings. Over 16,000 fine healthy plants were submitted for sale. In Cape Colony the grafted rootlings are sold by auction, and prices have gone to as high as £70 per 1,000, but ordinarily range from £17 to £30. It is proposed this season to graft chiefly those varieties in greatest demand, as :—

Wine varieties,	Carbinet, Malbec, Shiraz, Burgundy.
Table ,,	Gordo Blanco, Red Prince, Waltham Cross.
Drying ,,	Zante Currant, Sultana.

The completion of the water supply scheme was one of the important works of the year. An embankment was constructed to impound the flood waters of the creek. Engine, pump, and reservoir tank were erected, and the work of reticulation by piping for the distribution of water to the nurseries was carried out. This has given this station facilities it never previously possessed to successfully deal with young nursery stock, and was most urgently needed in this district of limited rainfall.

While the grafting operations were being carried out, public demonstrations were given weekly at the station under Mr. Dubois' direction on grafting in all its phases. These were well attended and much appreciated. Mr. Wyatt has also given field lessons in this important, but little known subject, at Ardmona, Dookie, and Tabilk. As the result of these lessons, which were of a high educational value, much interest was aroused, as well as knowledge imparted, and several grafting machines have been ordered by individual growers.

As hitherto no varieties of table grapes have been grown here, last year 2 acres were grafted with the best kinds for the production of scions.

Routine Work.

The ordinary routine of vineyard operations has been carried out here successfully as in former years. The pruning, disbudding, and picking, are done by contract. Other operations are carried out by the staff.

The value of keeping a loose surface, as well as the benefit of thorough cultivation, were fully proved by the yield when compared with other vineyards similarly situated, but not so well worked.

Manuring experiments have been again conducted, and the value of green manuring, referred to in last annual report, has been amply demonstrated.

Meteorological records are systematically taken, and embrace Barometric readings, Rainfall, Temperatures (Sun and Shade, Maximum and Minimum, Dry and Wet Bulb), as well as observations regarding Wind, Cloud, etc.

Provincial Experimental Stations.

The work of these stations has been carried out as usual, but owing to the lack of pence, as the result of retrenchment, but little could be spent on each. Trellising is most urgently needed on all the plots. The vines are now prostrate, and the canes grow in a tangled mass, which is detrimental to the wood. The vines planted in former years, and now established at these stations, may be expected to yield annually a large number of cuttings suitable for either grafting or planting. Those cuttings not distributed have been planted and rooted, and this year we have sold from Geelong station all the rootlings we could spare.

My sincere thanks are due to all the honorary managers for their unremitting efforts in carrying out experiments, often at considerable inconvenience, and collecting data that will, ere long, be regarded as valuable national assets.

As he has done since its inception, the Hon. Hans Irvine, M.L.C., carries out, in a most thorough manner, all work on the Great Western Experiment Station, free of charge, and provides the site on the same generous terms.

The data gathered last year, so far confirms the statement made in last report regarding the growth and adaptability to different soils of the various varieties of the resistant stocks.

Two new stations were opened during the year, viz., at Leongatha and Longerenong Experiment Farm. The strike and growth of cuttings at Leongatha were very encouraging, and it is proposed to root cuttings there and despatch the rootlings to such other districts as are not yet invaded by the phylloxera. This season it is proposed to extend the area at Longerenong to 5 acres. Rootlings are to be planted as mother stocks for the production of wood. The land has already been thoroughly prepared for that purpose.

We have four stations, viz. :—Great Western, Ararat, Leongatha, and Longerenong situated in districts remote from any phylloxera infection, and these will be utilised to furnish cuttings for clean districts.

The Experimental Stations now in existence are :—Rutherglen, Mooroopna, Bendigo, Great Western, Ararat (Mooney's Gap), Geelong (Batesford), Leongatha, and Longerenong. In addition to these, and by the courtesy of the Directors and Manager, we are allowed to inspect the various plots at Chatean Tabilk Vineyard, and record data of their experiments.

Last year 3,000 cuttings were sent to Mildura, and have made most gratifying progress at the station conducted by the President, Mr. Burbury, on behalf of the Horticultural Society. Here I have recommended the establishment of an official station, which would not only be of local value, but, owing to the rapid growth under irrigation facilities, would speedily provide all the wood required for the State. Some of the so-called College blocks, as pointed out in a special report, might, with advantage to the viticultural industry and the settlement, be so utilised and practically without cost. Experimental viticultural work is of supreme importance at the present juncture. Especially for the hitherto clean districts is this advisable, so that we may have reliable data. Reconstitution will then proceed on a sound basis, and vignerons thus situated will be enabled to avoid paying the heavy premiums that experience always demands from the uninitiated or unprepared.

General.

Mildura, an important viticultural area, was visited towards the end of the official year in response to a cordial invitation from the vigilant Horticultural Society. A lecture, illustrated by limelight views, was given in the Shire Hall, on "Phylloxera and the American Vines." The following day there was a public field demonstration on the grafting, &c., of resistant stocks. Advice and instruction were also given on several blocks I was privileged to visit in the limited time available. The eagerness to acquire information, and the genial reception accorded, amply repaid me for the discomforts of the tedious and somewhat unpleasant journey.

Correspondence during the year has been heavy, and over 3,000 letters have been despatched. Information by letter is eagerly sought by growers, and, wherever possible, the written instructions are supplemented by a personal visit. It is gratifying to note the appreciation with which the Departmental publications are received, particularly the translations of Messrs. Dubois and Wilkinson. This method of reaching and instructing the grower, should be extended and encouraged. The *Journal of Agriculture* has been the means of conveying a large amount of information to vignerons, as it has to other producers. Its reappearance is hailed with pleasure.

As we have no stock of the *Vitis Berlandieri*, the species most adapted for growth in limy soils, it has been decided to obtain cuttings of the same, if available, from the New South Wales Government. In this connection it should be noted that, in the absence of analyses of the soils, a calcimetre at the cost of a few shillings would, as previously recommended, prove invaluable. Till the percentage of lime in a soil is definitely known, it is difficult, if not impossible, to advise with certainty the most suitable variety of resistant stock for a particular soil.

Through the efforts of Mr. Dubois and the generosity of Mr. John Rock, Manager of the California Nursery Company, of Niles, California, we have received their complete collection of 34 approved

varieties of resistant stocks and direct producers. These have only just been received, and have been planted at Leongatha where they so far promise well.

Since last planting season, visits have been paid to practically all those growers who had received American vines from the Department, and a special and voluminous report submitted on the state of these vines in each case, their adaptability to the soils in the different localities, and, where grafted, their affinities. A brief descriptive report of the American and Franco-American varieties grown in this State was also written for circulation among growers who apply to the Department for this information.

During the year many hundreds of official visits have been paid to vignerons and others throughout the State. Without a single exception, officers of this branch have had most cordial receptions, and the eagerness to receive information renders the duty of imparting it a very pleasurable one.

Vineyards are as a rule well kept. In addition to the ordinary operations, cincturing, to promote the setting and development of the fruit, has again been practised in the few districts where Zante currants are grown. Cincturing increases the returns considerably, but care should be taken not to make the cincture too wide.

Grafting the resistant stocks has been attempted by several growers in the Goulburn Valley, among the most successful being Messrs. C. Lenne, Prossor, Burney and Gugger.

The Wineries at Stawell and Yarrawonga were also officially visited during the year, and special reports furnished thereon as instructed.

A considerable amount of time has been taken up with the lectures for the Agricultural Classes. The subjects undertaken by this branch are Viticulture and Agricultural Botany. In the latter subject especially, considerable interest was stimulated, the lectures so far having proved conclusively that facts of this science, suitable for agriculturists, may be taught without undue use of abstruse technicalities, and without impairing the instruction or reducing the interest this fascinating subject should invariably arouse.

A short course of lectures on "Nature Study" was also given by request of the Education Department, at the University, to the Summer School of Teachers.

Parasites and Diseases.

The phylloxera is of course a permanent settler in this State, and is by far our most serious pest. So far as is known, it has not invaded any other parishes since the issue of last annual report. In the infected districts it is spreading, and the destruction of phylloxerated vines has been accelerated by the drought.

White ants have in isolated instances proved troublesome by tunnelling the stocks. These invasions are usually due to decaying stumps and roots being left in the ground, and the insects leave these to attack the vine.

The Rutherglen bug has not been so bad on vines this year as it is sometimes. Early in the season cut worms caused a little trouble among cuttings and grafts.

Fungus diseases have not been very serious for several seasons owing to the adverse climatic conditions prevailing. After seasons such as we have been having recently, it would be a splendid opportunity for growers to get rid of spores by swabbing the vine trunks with some approved fungicide.

In Geelong, a few cases of oidium were noticed in private gardens on trellised vines, and as is usually the case with amateurs, the disease was not noticed till practically beyond remedial treatment for the present season.

Anthracnose, popularly known as black spot, or birds' eye rot, has been of rare occurrence, and the attacks of usually a mild character.

Pourridié, the comprehensive term which includes all parasitic root fungi, has also not caused the complaints this year, nor apparently the trouble it has been responsible for in other seasons. The source of this infection is also most frequently the decaying roots of forest trees left in the soil when clearing. Broussin was only noted in solitary instances here and there.

In conclusion I may state that all the energies of this branch will be devoted in the future, as in the past, to the very important work of promoting the reconstitution of the Victorian vineyards. This is now the only hope of the important viticultural industry.

REPORT OF THE CHIEF INSPECTOR OF STOCK.

J. R. Weir.

Pastures.

The absence of rain during last spring in the northern areas, and the prolonged drought throughout the summer, has been a bitter memory to residents in localities which, under ordinary conditions, would have been able to sustain the flocks and herds upon them, from which in many instances fat stock would have been forthcoming. But during the past summer, in many cases, these lands were nothing more than arid stretches, which seemed as though no grass had ever grown on them. Fortunately south of the Dividing Range there was a plenteous rainfall, and not only had these lands to carry large quantities of stock from the northern districts of Victoria, but also from Southern Riverina, the crossings of stock into Victoria along the Murray River having been greater during the past year than for many years.

In some of the northern districts, within touch of, and irrigated from the Goulburn River, lucerne was profitably grown, also amber cane and sorghum. With the breaking up of the long drought and the hardship the ordinary pastures had endured, in very many cases the first herbage that asserted itself was of a class not only unsuited for stock, but at the same time positively dangerous for them to eat. Under circumstances more fortuitous, this class of plant would not have been looked at by them, but the poor famished brutes eagerly cropped off anything that came up, in their anxiety to fill themselves. Very much of this food was of the Euphorbia and Solanum families, and as a result of their eating these plants many deaths occurred amongst cattle, sheep and horses.

Diseases.

Pleuro-pneumonia.—A few isolated cases have occurred during the past year, but the losses were in no case great, and all contacts were quarantined and inoculated. At the time of writing so far as I am aware, there is no herd in the State affected with it.

Anthrax.—A few outbreaks of anthrax were recorded during the year, but in nearly every case the contagion was effected through the use of Indian bone meal, of which a quantity was imported into this State, and which had been supplied to stock to make up for lack of phosphates in the soil. The disease has been kept in check, however, and by isolation, observance of sanitary precautions, and vaccination of the balance of affected herds, there is every reason to believe we may not have a recurrence of this trouble for some time to come.

Gastric Troubles.—These have caused the loss of quite a number of animals in this State from reasons already given. At Springvale,

47 animals died in one night through gorging themselves with cape-weed, others again through feeding on the black nightshade *(Solanum nigrum)*. Of the action of this latter plant on stock, I cannot do better than quote from the late Baron Von Mueller, at one time Government Botanist in this State. Writing under date, 29/3/73, he states, "I have the honor to inform you that the herb which produced poisonous effects on the cattle of Broadmeadows is the *Solanum nigrum*, called in Britain the annual nightshade. The most active principle of *Solanum nigrum* is a glucosid (solanin), and this is most strongly developed in the unripe berries. Solanin produces paralysis of the extremities prior to death, when consumed in quantity."—(*vide* Annual Report of the Secretary for Agriculture, 1873.) This opinion is corroborated by the report of the then Government Analyst, the late Mr. Wm. Johnson, F.C.S., which accompanies Baron Von Mueller's report.

Worms in Horses.—From various districts reports have come to hand of losses occasioned by the presence, in large numbers, of worms in the stomachs and intestines of these animals. At Sale particularly there has been a heavy mortality among horses, caused by the presence in the stomach of great numbers of a worm, which on the authority of Professor Spencer, of the Melbourne University, is the *Scelerostomus*. These worms perforate the mucous membrane of the stomach, and are present in great numbers. Their habitat appears to be morass lands, and muddy water, and when they gain ingress to an animal's stomach they appear to increase very rapidly in numbers.

Tuberculosis.—During the year, the number of recorded cases of tuberculosis has shown a marked decrease.

Actinomycosis.—As might reasonably be expected in a season like the past, there have been a number of cases of this disease recorded, but few animals have been slaughtered on account of it, and then only, when through the neglect of owners, the disease had assumed an aggravated form, and the animal was worthless. From the northern districts come reports of several cases of what are commonly known as "grass lumps," which, however, when opened up freely rarely give any further trouble.

Swine Diseases.

In the early part of the present year, a number of pigs died in one of the Northern districts through over-feeding at a boiling-down establishment. The animals, stores, were allowed to gorge themselves at will on the boiled meat, with the result that septic intoxication set in. The pigs thus affected were covered with necrotic spots on the belly, shoulders, fore-legs, throat and back. Many of them died, and when the feeding conditions were altered the deaths ceased. Again in March, Mr. John Robertson, Superintendent of the City Abattoirs, directed my attention to a number of pigs condemned by him as unfit for human consumption. Specimens from these animals submitted to Dr. Bull, Bacteriologist at the Melbourne University, for investigation

were pronounced not swine fever affected, but that the animals were suffering from necrotic dermatitis. A line of pigs within a short distance of Melbourne thus affected, on being subjected to treatment and careful attention paid to them, recovered and have since been fattened in the same premises and sold. From time to time reports were received of disease existing in pigs, until from an animal which died at Black Flat *post mortem* specimens were taken, and from these Dr. Bull, after careful and painstaking research obtained the bacillus of swine fever. The day following the discovery of the disease at Black Flat, Mr. Robertson found several animals affected at the City Abattoirs, and in the *post mortem* specimens taken from them and submitted to Dr. Bull, this gentleman discovered the bacillus of swine fever. Stringent measures based on the regulations in force in the United Kingdom for the suppression of this disease were at once submitted for the consideration of the Director of Agriculture and decision of His Excellency the Governor-in-Council, and it is to be hoped that with the co-operation of the owners of pigs this disease may shortly be stamped out. Amongst these measures are included—Attention to sanitary details by absolute cleanliness and thorough disinfection of premises, together with care for the comfort of pigs, checking the movement of pigs by only allowing fat ones to be removed and then not until after inspection. Pigs thus removed will only be for immediate slaughter, as the experience of other countries has been that store pigs act as the bearers of the contagion from one district to another. Whether the present outbreak is but the recurrence in this State in a more virulent form of a disease which some years since caused the death of a large number of pigs, or whether it has been introduced into this State from New South Wales, is a matter upon which no definite conclusion has been arrived at. There are many who aver that the present outbreak is merely the reappearance of an old trouble, while others again assert it has been introduced from New South Wales, so that its origin in the present instance is obscure. That it may be stamped out by owners of pigs doing their utmost to assist in its eradication I am convinced, as has been done in the case of scab in sheep, but without their assistance legislative enactments are powerless. Taken as an adjunct to what may now be regarded as one of the principal industries in this State, dairying, the pig is an asset of considerable importance, as in addition to the number which are required for local consumption, other States draw large supplies from Victoria. In their own best interests then, it is imperative that all interested should strive to stamp out this disease.

REPORT OF THE ENTOMOLOGIST.

C. French, F.L.S., F.R.H.S.

In submitting my report for the year, I have the honour to state that the work in this branch is still rapidly growing both in magnitude and importance, the number of visitors calling on Departmental business having also largely increased. The number of specimens submitted to me for examination still continues to be very large and is decidedly on the increase, occupying a great portion of the time of myself and assistant.

Reports.

Reports on the following subjects have been furnished to the Department, viz.:—"Size of Fruit for Export," "Root Borer," "San José Scale," "St. John's Wort," "Amended Vegetation Diseases Act," "Hawthorn Hedges," "Dip for Fruit Cases," "Beechworth Asylum Grounds," "Opuntia," "American Vines at Rutherglen," "Weed Destruction on Railway Lines," "Results of Codlin Moth Experiments," "Expenditure on Grasshopper Fungus Distribution," "Grain from India," "Trees in Burnley Gardens," "Diseased Fruits for Factory Use," "Visit to Lobb's Orchard," "Poisonous Spider" *(Lathrodectus)*, "Prosecutions in Markets and Shops," "Shed for Examination of Fruit for Export," etc.

Correspondence.

The correspondence connected with this branch is rapidly on the increase, many of the questions are, I am pleased to say, showing more intelligence than heretofore. In all cases correspondence is either replied to by myself or the reply is sent by my assistant under my direction and dictation, so that correspondents, no matter who, cannot possibly be kept waiting for a reply to their letters, and from the commencement of my term of office the same degree of punctuality has been strictly maintained. I have again to point out the necessity of always sending a note when forwarding any parcel of specimens for identification, so that the matter, where at all possible, may be attended to at once.

I am glad to be able to state that the same friendly correspondence with entomologists in the sister States, as also with those of foreign parts, still continues.

As showing the increase in the work of correspondence, it may be stated that 4,194 letters were entered in the book for the year.

Literary Work.

In literary work the principal has been the various articles contributed by me to the newly established Victorian *Journal of Agriculture*. It is to be hoped that sanction will soon be given for the publication of Part IV. of my book on the *Destructive Insects of*

Victoria, the first edition of 8,000 copies of Part I. having already been disposed of, while the demand for Parts II., III. has been quite up to expectations.

Investigations and Experiments

The principal publication in connection with the above has been the *Guide to Growers No. 49,* this having been published and sent out in time to help growers and to save a season. This pamphlet which embodies the results of the experiments of Messrs. Cock and Meeking, is a valuable contribution to the Departmental literature, showing as it does, that with care and persistence a grower, no matter though he be in the centre of a codlin moth infested district, can save from 90 to 95 per cent. of marketable fruit, and the writer is prepared to prove this to the most sceptical. It has been decided to re-publish this report and others bearing upon the subject, together with the photographs taken in the various orchards in which the experiments were carried out.

The grasshopper fungus has been a greater success than we had anticipated, the applications for supplies numbering 1,207, the number of tubes posted being nearly 5,000. In view of this success, I beg to suggest that a small charge be made for the material and postage, as the fungus costs a good sum to prepare for use. I also propose to test this material on a much larger scale than has hitherto been attempted here. On large areas a few tubes are of comparatively little use and the effects barely noticeable. If I be not mistaken the utilization of this important South African discovery bids fair to stamp out the grasshopper pest, which is certainly one of the most formidable in our State. The conditions under which the fungus may be sent out have not as yet been determined, but of these due notice to the press will be given. Applications for the fungus should be made not later than the end of September.

Experiments on the San José scale with lime, salt and sulphur have been very successful, and we hope gradually to reduce this source of danger to a minimum.

Root-borer is still in evidence, but only in the older orchards where it is most difficult of eradication, various traps are being tested, and we hope to be able to report success ere long.

Recent and persistent experiments would indicate that we have now but little to fear from the black peach aphis, the muriate of potash, or more properly potassium chloride at the roots, combined with spraying, having produced the best results, the green aphis being more difficult of eradication.

The onion fields in many parts of the State are badly infested with the eel worm *(Anguillulidæ)*, also with minute wire worms, and the larvae of a dipterous insect closely related to that well-known scourge of the onion-grower—the "onion fly." Experiments are now being carried out by this branch, the object being to endeavour if possible to arrest the progress of the trouble and to restore the valuable onion grounds throughout the State.

That pernicious weed known as St. John's Wort still continues to spread and flourish. Late experiments, however, have proved that this weed is amenable to treatment, but to secure practical results a large monetary outlay will be absolutely necessary

The Loranthus, or mistletoe trouble, has again cropped up, and I have furnished a report on same, and feel certain, if my recommendations are adopted, that much good will result, the matter from a forestry point of view being a most serious one.

In connection with the investigations and experiments, I may mention that a number of lectures to growers have been given in various parts of the State, most of the lectures having been well attended.

Museum of Economic Entomology and Ornithology.

Since presenting my previous report many additions have been made to the collections here, especially in the life-history work, mostly contributed as before by myself and assistant, C. French, Jr., also by the acquisition of several small lots purchased from persons who were either giving up or leaving the State.

The fine collection of insectivorous birds has also been materially added to and now forms a most interesting collection, the privilege of the examination of which is largely availed of by the rural public, teachers and others.

A visit from sixty teachers from the Summer School at the Training College caused many subsequent enquiries, as has also the valuable "Nature Courses" now, we hope, firmly established in our schools.

Library.

The library connected with this branch has not been added to much of late, although some fine works as *"British Coccidæ," "Indian Scale Insects," The Zoological Record,"* the various valuable American publications, and also those of Australian entomologists are welcome additions to the fine collection of books. It is to be hoped that with the improvement of our finances we may be again able to keep the library up to date. A large number of valuable books urgently require binding, and a list of all books and publications in the library is now in contemplation.

Country Exhibitions.

The important work of making this branch and its work known principally in country districts has not been overlooked. The following are places to which specimens have been sent and exhibited under Mr. Knight's supervision:—Lang Lang, Daylesford, Buln Buln, Melbourne, Geelong, Yarrawonga, Benalla, Nhill, Sale, Bairnsdale, Kyneton, Kilmore, Mansfield, Warrnambool, Cobram, Charlton, Echuca, Seymour, Yarram, Traralgon, Frankston, Box Hill, Fitzroy, Birregurra, Cheltenham, Wedderburn, Windsor.

Vegetation Diseases' Act.

For the proper administration of the above Act it was found necessary to introduce some amendments, amongst the most impor- of these being a Proclamation by the Governor-in-Council making it a punishable offence to dispose of or attempt to dispose of, fruit which was diseased, either in the markets, shops or elsewhere. There have been several successful prosecutions of persons offending against these regulations, and although some opposition to the Act, as it now stands, is not improbable, the new departure is looked upon with favour by a large number of our principal growers, who see in the rules a lever by which the Department can keep growers up to the necessary work of cleaning their orchards. It has been found necessary to add to the list of prohibited insects and fungi, these lists having been prepared by Mr. McAlpine and myself.

Inspection of Orchards, Nurseries and Gardens.

The inspectorial staff having been increased by the addition of two regular Inspectors and one Assistant Inspector, the work done continues to be fairly satisfactory although the staff is even now far too small to be thoroughly effective, and as the planting of fruit trees is progressing at a rapid rate, it will be at once seen that the inspection is to a large extent insufficient.

Prosecutions against careless growers have been fairly numerous and quite successful, it being unfair to the careful grower to permit the careless man to allow his orchard to become a breeding ground for disease, whilst the former grower is doing all that he can, not only to keep his orchard clean, but to place his fruit on the market in such a condition that it will be certain to command the highest price.

The inspection of nurseries is one of the most important measures of the Act, as every practical grower is aware that it is in the nursery where the principal danger of infection lies, as if the tree be affected when transplanted from the nursery to the orchard, the disease becomes at once established on a permanent basis, whereas in the fruit the chances of infection are much more remote. Upon the whole the Act is found to be working both well and fairly smoothly, although certain of the troubles arising from an over anxiety exhibited by many of the sister States, as also by countries outside the Federation, give no end of concern and trouble to our plant growers who take every care that only the best and cleanest stuff shall be sold to growers both inside and outside of the State of Victoria, the number of certificates issued by this branch being 1,931, the number of cases and bundles of plants and fruit trees exported being 3,637.

It is my pleasurable duty to report the destruction by uprooting and burning of a large number of the old and abandoned gardens throughout the State, these having for years been not only an eyesore to most of us, but also an actual and a serious menace to the careful orchardists, nurserymen, and to the owners of small private gardens, at which latter places there yet remains much to be done.

In the markets and shops much has been done, and in the case of these places copies of the Proclamation before alluded to have been printed in both the Greek and Chinese languages, and then distributed broadcast amongst growers and dealers belonging to these nationalities.

Fumigation.

All trees and plants coming into the State have to be sent to Burnley Gardens for fumigation, whilst some of the nurseries have a fumigating plant of their own which is used for treating nursery stock as required. The cyanide gas tent belonging to this branch is being used as occasion offers.

Miscellaneous Insect and Bird Troubles.

The cut worms have been much in evidence of late, as have also the larvae of a moth *(Oncoptera)*, but by a timely application of colonial gypsum in the proportion of from 1½ cwt. to 2 cwt. per acre we have managed to keep these pests fairly well in check.

On grass lands, as paddocks, bowling greens, etc., the larvae of a small brown beetle *(Haplonychus)* has been working great havoc, but the sulphate of iron treatment bids fair to stamp out this particular trouble.

The English starling promises to be one of the greatest enemies of fruitgrowers, and a plebiscite of growers is now being taken to decide whether the Agricultural Department is to be asked to take steps to have the protection to these birds removed or in some way modified, the damage at present done by these birds being most serious.

Examination of Imports and Exports of Fruit, Plants and Grain.

A glance at the figures submitted for the past year shows a satisfactory increase in the fruit exports from this State.

In the table devoted to imports it will be seen that a great proportion is made up of bananas from Queensland, over three-quarters of a million bunches having been received, and of these the Inspectors have condemned 2,327 bunches, and over 1,000 loads of loose or refuse bananas. These latter, after steaming, are supplied free of charge to the cowkeepers who use them as a food for their cattle.

It is most gratifying to note that neither of the much dreaded fruitflies has as yet obtained a foothold in our State, although one has shown itself in countries which are colder than our portion of Australia.

The work of the office of which Inspector Turner is in temporary charge is steadily increasing, with the growth of the export trade and the additional work of examining all grain imports. The letters and distribution of circulars amounted to 1,357, and the tables compiled by Inspector Turner, appearing under the heading of Statistics, will speak for themselves.

I have again to thank those who have contributed either to the literature or to the economic collections of the branch, as also my assistant and the Inspectors for help in field work and experiments.

REPORT OF THE VEGETABLE PATHOLOGIST.

D. McAlpine.

The work done during the period covered by this report has been of a very varied character. There are few, if any, of our cultivated plants which are not liable to some disease, and even although the spring was so dry and the summer so early, between 700 and 800 specimens were sent in for determination. In addition to this, experiments were continued and extended in connection with the treatment of various diseases, and lectures were delivered at the request of societies anxious to gain information as to the best methods of dealing with the diseases prevalent in their respective districts.

Publications relating to the Diseases of Stone-fruit Trees and the Black Spot of the Apple and Pear have also been issued, and a number of articles contributed to the *Journal* of the Department on current diseases and their remedies, as well as kindred subjects. The editing of the *Journal* necessarily takes up a considerable portion of my time, and since the day must be largely devoted to microscopic work, correspondence, &c., the evenings have often to be spent in looking after matters connected with the bi-monthly publication. In this, as in other matters, I have the loyal co-operation of my Assistant, Mr. G. H. Robinson, without whose aid it would be next to impossible to give the necessary attention to microscopic researches and experimental work, which are essential in this branch, if progress is to be made.

During the present season, experimental work will be largely increased and extended at the instance of the Director of Agriculture, who has imported the best varieties of the celebrated Garton wheats, oats, and malting barleys. These are not only being tested in single seed plots in different localities, but several acres are being grown to provide seed for next season's crop. A supply of seed has also been obtained from the United States Department of Agriculture of a number of the best forage plants and grasses, including saltbushes, and these are being tested, at first in what may be called pocket-handkerchief plots, before being sown on a large scale, as explained in *Guides to Growers, No. 38,* Experiments with Fodder Plants. A commencement has also been made in the cultivation of our native grasses.

The summary of the year's work may be conveniently grouped under the following heads :—I. Experiments. II. Principal Diseases of the Year. III. Publications. IV. Miscellaneous.

I.—Experiments.

Black Spot of Apple and Pear.

Although not so prevalent as in the preceding season, this disease caused a deal of loss where spraying was not carried out, but I am

happy to say this operation is becoming more general every year. While the Bordeaux mixture, with the formula 6·4·40, is now commonly adopted, growers are constantly making inquiries as to the advantages of adding this or that ingredient to the mixture. So one set of experiments were directed to settling this question for a number of substances, such as sulphate of ammonia, sal-ammoniac, saltpetre, and common salt. These experiments were carried out at Mr. A. F. Thiele's orchard, Doncaster, and since detailed results will be given in the next issue of the *Journal*, it is only necessary to state here, that while 90 per cent. of the fruit on the check plot was affected with spot, the Bordeaux mixture of the 6·4·40 formula reduced it to 9·6 per cent. There was a slight difference in favour of the addition of common salt at the rate of 1 lb. to 40 gallons of the mixture, there being only 9·4 per cent. of spot in that plot. The Copper-soda mixture was also tried, at the rate of 6 lbs. bluestone and 9 lbs. washing-soda to 50 gallons of water (6·9·50), and the result was 14 per cent. of spot. The soda in the mixture does not give the adhesive quality of the lime.

In these experiments only one spraying was given, on 1st November, and the variety of apple chosen was Yates. A second set of experiments were conducted at Killara on the Buncome apple, but because of the lesser susceptibility to the spot, and, perhaps, also on account of the season being by no means favorable to the disease, no very definite results were obtained, though the sprayed trees were all much cleaner than those unsprayed.

Bitter Pit.

As this disease had been very prevalent at Pakenham during the season of 1901-02, it was considered a suitable locality for testing the effect of various treatments. Mr. Hatfield kindly placed at our disposal a number of his trees, and the Sturmer Pippin was chosen, because this variety had suffered most from the disease. Five plots were selected, in which the conditions, age of trees, &c., were as nearly equal as possible, and there were 10 in each plot.

Plot 1.—Complete Manure.
2.—Potash Manure.
3.—Check.
4.—Gypsum.
5.—Potash and Gypsum.

Owing to the peculiar nature of the season, there was very little bitter pit at Pakenham in this particular variety. It was very dry at the beginning of the season, and the fruit grew very slowly. As a general rule, it is found that if the fruit grows rapidly and matures quickly it is most likely to become affected, but when the season encourages slow growth, and the apples are much smaller than the average, as in this instance, then there is very little of this disease.

The apples were picked in the beginning of June, and there was no bitter pit to speak of, the fruit not being very large, although there was a good crop owing to the dry spring. There were also

several severe hailstorms which marked about one-third of the Sturmer's. Altogether no definite conclusions could be drawn as to the effect on bitter pit of the various manures applied. It is anticipated that the coming season will be favorable to this disease, and the experiments will be repeated with some additions.

In the reports of Mr. Sinclair on Victorian Fruit in London, as recorded in the July *Journal,* the bitter pit was very much in evidence. Consignment after consignment had numerous cases affected, and such fruit was sold at less than half the ruling prices. The varieties specially named were, Ribston Pippin, Cleopatra and Bismarck. Numerous individual samples of bitter pit were sent in for determination, and Cleopatra seems to be the worst in this respect. Considering that this is a favourite apple for export, and brings the highest prices, it is most important that growers should be able to forward it free from this disease. Whatever checks the too rapid growth of the fruit, and will enable it to mature slowly, is a factor in the prevention of this disease. And to secure this result the land should be deep drained, lime should be applied, and any other deficiency in the soil made good with a suitable manure.

Rust in Wheat.

The results of the year's experiments have shown, as already recorded in the *Journal* for July, that Rerraf still maintains its reputation as a rust-resisting wheat, and a yield of 48 bushels per acre during the past season at Port Fairy, weighing 62 pounds to the bushel, is a very satisfactory record.

The milling quality, or the quality of the flour it yields, is a very important point, and while the Analytical Chemist to the Department of Agriculture in Sydney states that it cannot be called a first-class milling wheat, a local miller reports that it is excellent. During the present season several farmers are growing it on a large scale, and small samples have been sent out to different districts. In this way its suitability to our varying conditions will be tested, and its ability to withstand rust proved.

It is sometimes made to appear as if no progress had been made in dealing with the rust question, but the practical solution of it is gradually being discovered by growing wheats that resist the rust under severe test conditions, and are commercially valuable to the farmer; also in producing new strains of wheat by crossing, suited to our conditions, as Mr. Farrer, of New South Wales, has so long been successfully doing.

Some time ago the late Sir J. B. Lawes, whose agricultural experiments at Rothamsted are of world-wide fame, wrote to me pointing out in what directions he considered it would be desirable to carry out investigations in connection with rust, and he stated: "I have no doubt that if I grew wheat which had previously been grown in a hotter and drier climate than that of England, I should have a crop destroyed by rust. I have no faith in specifics; you must try and obtain wheats which will grow well in your climate. It will, of course,

take some years of experiment to obtain what you require, but I feel sure that you are more likely to succeed if you direct your attention to obtaining a rust-resisting wheat than by trying specifics or by manures."

Variety Tests of Wheat, Oats and Barley.

The work of testing promising varieties still continues, and several of the cross-bred wheats which Mr. Farrer generously forwards every year for trial, have been retained on account of their superior qualities. Some of them are more suitable for the Mallee than coastal districts, and it is to be hoped that when Experimental Stations are officially established in different localities such a special district as the Mallee will receive consideration. The work done at Port Fairy for a number of years is now beginning to bear fruit as the results obtained there are becoming better known. New varieties of wheat, oats and barley obtained from different countries are constantly being tried, and wherever they give promise of being useful additions, small samples are sent out to different districts for testing their suitability to other localities. In addition, new crosses of wheat from Mr. Farrer are being regularly and carefully tested and their qualities fixed, and the selection and improvement of the seed has always been recognized as a leading factor in success. Thus, in the case of Rerraf wheat, which yielded at the rate of 48 bushels per acre in the past season, the advantage of constant selection in improving the plant and increasing the yield is clearly seen. A small sample was first received from Mr. Farrer in 1898, and selected seeds grown in the single seed plots. Then the best plants only were selected for next year's seeding, and in 1899 it was grown on a much larger scale. Sufficient was obtained to grow a plot of 1¼ acres in 1900, and it has now been grown on a large scale for three successive years, yielding at the rate of 31⅓, 40, and 48 bushels respectively. The elements of successful cereal-growing are all attended to at Port Fairy—growing suitable varieties, careful cultivation, judicious manuring, and a rigorous selection of the best plants with plump clean seed.

The celebrated Garton varieties of wheat, oats, and barley, already referred to are being thoroughly tested in the Goulburn Valley this season as well as at Port Fairy and Leongatha. These new breeds are the result of crossing experiments begun in 1880 by Garton Bros. at Newton-le-Willows in Lancashire. They obtained the cultivated and wild varieties of grain from all parts of the world and crossed them with the kinds grown in Britain. The improved varieties thus secured have marked a new era in regard to quality and yield, for some of the new breeds of oats, for example, Waverley, have yielded as high as 104 bushels per acre. The following varieties are being tested: Wheats—New Era, Red King, White Monarch, White Pearl. Oats—Waverley, Tartar King, Pioneer Black, Goldfinder, Abundance, and three unnamed varieties. Barleys—Standwell, Invincible, Brewer's Favourite, and two new breeds.

It must be borne in mind, however, that a high reputation possessed by a variety in another country is no guarantee that it will

do well and suit our conditions here. Hence the necessity for testing and trying even the highly praised Garton varieties before introducing them into general cultivation.

Stinking Smut Experiments.

The experiments were directed towards finding out the simplest, cheapest, and most effective method of treating seed-wheat for the prevention of smut.

The substances used were narrowed down to three, viz., bluestone, formalin, and corrosive sublimate, and the good results of the treatment in each case were very evident. The check or untreated plot yielded 91 per cent. of smutty ears, while that treated with bluestone solution gave only $\frac{1}{12}$ per cent. of smutty ears, and in the case of formalin $\frac{1}{3}$-$\frac{1}{4}$ per cent., but as details have already been given in the *Journal*, they need not be repeated here.

The two substances most practical for treatment are bluestone and formalin, and experiments are being carried out this season to see how far the one or the other should be recommended for general use.

Hops.

In connection with the improvement of the Hop industry it was considered advisable to import some of the best varieties from other countries in order to see if they were suited to our conditions, and capable of being grown here profitably. Some of the best Kentish varieties have already been distributed, and now the Californian hop-sets, which arrived, on the whole, in good condition have also been sent out. Since the climate of California is somewhat similar to our own, there is every reason to believe that they will become established successfully here, and I am supported in this opinion by an old and experienced hop-grower, Mr. Donald Gow, of Harrietville, who writes :—"The introduction of the Californian hop to Victoria, is, I feel confident, a step in the right direction, which ought to have been taken many years ago."

II.—Principal Diseases of the Year.

It might be imagined by those not familiar with the staying powers of fungi, that the dry season through which we have passed would keep them in check, and no doubt it has to a certain extent. But, on the other hand, fungi are so capable of adapting themselves to their surroundings, and so fertile in expedients, for withstanding the effects of excessive drought, heat or moisture, that they often survive when the higher plants on which they prey have succumbed. They can do this in two principal ways, either by means of their vegetative mycelium or "spawn," or by giving rise to reproductive bodies. The mycelium may be so changed that it is capable of great resistance, as in the case of sclerotia, or it may become perennial in the tissues of the host-plant. On the other hand, reproductive bodies may be produced often in great variety and in immense numbers,

and some of these are specially adapted to survive until favorable conditions arise for their germination. All this shews the necessity to the grower of some knowledge of the nature and habits of fungi, if he is successfully to combat them, and such a need is freely recognised by the Department. In addition to various Guides to Growers and Bulletins, there are already available in this Branch, Handbooks on the Diseases of Vines, Stone-fruit Trees, Citrus Trees, and of Cabbage and Cauliflower, and these are being gradually added to, so that we hope soon to have every branch of agricultural and horticultural industry provided for.

In the Agricultural Classes recently established by the Director of Agriculture, provision is made for the subject of Vegetable Pathology being taught by means of lectures and practical illustration, so that every facility is given to those desirous of information. There can be no doubt that as the diseases of plants receive closer attention, and the latest available information is acquired, growers will be more fully alive to the risks they run, and will the more readily avail themselves of the best known methods of treatment. In the course of the year, specimens of almost every cultivated plant have been submitted to me for some real or supposed disease, and in making a selection of the principal diseases met with only a few of the more prominent can be noticed.

Potato Diseases.

There are several diseases of the potato which are becoming rather serious, and will require to be attended to, not merely to save the immediate crop, but to prevent their spread to districts where they do not now exist. The potato disease of other lands has not yet found its way into Australia, but there are others which seriously affect the crop, both as to yield and quality. Some of them will afterwards be treated at length, but at present the following will be briefly noticed, as they have been investigated recently:—Early Blight, Blister, and the Sclerotium disease.

Early Blight.—This is a disease which has been known here for a number of years, as in 1896 I called attention to it as "A new Potato disease," and it has been referred to in previous reports. Although at first confined to certain districts it seems now to be spreading, and will require careful attention at the hands of the growers. It is known as early blight in contrast to *the* potato disease of older countries, often referred to as late blight. It also occurs in America, Europe and in New Zealand, and in the latter Colony it seems to be very prevalent. It is caused by a fungus known as *Alternaria solani.* Since this disease has been carefully investigated, it will be be treated in detail in a future issue of the *Journal.*

Blister.—In April of this year some potatoes were forwarded to me from Mount Gambier in South Australia, in which the surface was covered all over as if with blisters, hence the common name applied to the disease. On examination this appearance was found to be due

to innumerable nematodes or thread-worms. So far this disease has not been met with in Victoria, but Dr. Cobb figures a specimen in the *Agricultural Gazette* of New South Wales, 1897, page 244, in which the surface is covered with numerous lumps, and he estimates that the one potato contained at least 10,000 eggs and worms. One should be careful in the matter of seed-potatoes, and utterly reject all those which have such knobs or blisters on their surface, as it is a sure means of permanently infesting the land with the thread-worm. And this gall-worm is not particular as to the kind of plants it attacks, for it is equally at home in the orchard, the vineyard, the forest, or the garden, and may be found on the peach or orange tree, the tomato or beet, the cabbage or the maize.

Sclerotium disease.—Potato plants were forwarded to me in March by Inspector Cock which were decaying above ground and tubers underground did not mature. The stems were the parts particularly affected, and they became dry and brittle, finally falling down. On examination, numerous little black hard bodies, like small shot, were found in the interior of the stem, and these are known as sclerotia. This is a form which a number of fungi assume when they have used up all the available food and pass into winter quarters in order to prepare for renewed activity in the coming spring. When the stems lying on the ground decay and break up, these little black bodies are set free and rest until the next spring, when they produce innumerable spores or seed-like bodies. These germinate at once and grow luxuriantly among decaying matter, from which the fungus threads readily pass to living plants, attacking the young stems just about the collar. Here they soon spread and absorb the material which would otherwise go to build up a healthy potato plant. When the supply of food is exhausted, the fungus passes into the sclerotium stage and again repeats the process already described.

From the very nature of this fungus it will be seen that clean cultivation is essential, so that no decaying refuse is allowed to form a harbour for it.

Diseased portions of the plant should also be collected and burnt, before the sclerotia are set free, in order to get rid of them.

Where this disease has occurred, it would be advisable to apply a dressing of lime to the soil, as it would tend to destroy the early stages of the fungus before it had attacked the living plant.

Since decaying matter is essential to its early existence, fresh stable manure on the surface of the soil greatly encourages its spread.

Black Leg of Cauliflower.

This disease was rather prevalent during the past season, and some very bad specimens were forwarded from South Australia. In previous reports the fungus causing this disease has been described and methods of treatment given. It was pointed out that the danger arises in the seed-bed, and the only means of checkmating this fungus is to sow seed in absolutely new ground, where no cauliflower, cabbage or turnip has previously been grown. If such ground

is not available then at least three or four years should be allowed to elapse before laying out the seed-bed on ground previously occupied by these plants. There is little or no danger of the plants being attacked *after* they have been set out in the fields, hence to ensure a good crop every care should be taken in the selection of the young plants, and only healthy ones with absolutely clean, sound roots should be used.

Root-rot of Fruit Trees.

Rotting at the root may be due to a variety of causes, and in investigating diseases of this nature which are at first hidden and underground, one must be particularly careful to assign the symptoms to their proper origin and make sure whether organic or inorganic agencies are at work. If the soil is undrained and sour, and stagnant water collects at the root, then this is sufficient in many instances to cause decay. "Wet-feet" is a fruitful source of decay and death. There are numerous cases, however, where fungi are not the after effects of such conditions, but actually promote and produce decay. This happens with quite a number of different plants both in our forests and orchards, and from the insidious nature of the disease it is often widely distributed before its true cause is discovered. The losses due to root-rot are enormous, and the causes, if possible, should be removed. There is one fungus which has been very common during the past season, and is recognised all over the world as a dreaded root parasite, viz.:—the honey agaric *(Armillaria mellea)*. It is very prevalent in orchards around Doncaster and elsewhere, and attempts have been made to prevent its ravages. It is found that the sovereign means of prevention is drainage, for not only is a healthy growth promoted thereby, but the conditions are inimical to the growth of the fungus. This, combined with a dressing of lime, is said to be fairly effective against it, and an orchardist who laid bare the roots of his apple trees and applied sulphate of iron dissolved in water met with promising results. It will be necessary, however, to carry out a systematic series of experiments before one can make definite recommendations, but I have seen the differences so marked in the drained and undrained portion of the same orchard, that there can be no doubt as to good drainage being a valuable aid in checking its spread.

Blue Mould of Wheat.

Early in June a batch of young sickly wheat plants were received from Inspector Davey at Horsham. The trouble was stated to be general and serious in that district, patches of the crops becoming withered and soon dying. On examination, the seed was found to be covered with the common blue mould (*Penicillium glaucum*), but more than a fortnight had elapsed before the plants were received by this branch.

Some fresh seed was shaken up in water in which some of the diseased plants had been steeped, and a portion sown in sand, and another portion on damp blotting paper. Those on the blotting paper showed the blue mould as soon as germination commenced,

but in the sand a perfectly healthy crop was grown. Though under certain conditions the common blue mould is capable of doing much injury to plants, yet in this case there is no evidence of any value to associate the sickly condition of the plants with this very common fungus.

Tobacco Mould.

This disease is very variable in its occurrence, being largely dependent on climatic conditions for its development and spread. Hence, experiments directed towards its prevention have often to be conducted for several seasons before a satisfactory result is obtained. Thus a number of different methods were tried at the Experimental Tobacco Farm, Edi, during the years 1899, 1900 and 1901, but no definite results were obtained the first two years owing to the absence of the mould. Again no mould appeared in any of the beds during 1902, so that for the last four years only one season was favourable for testing the various remedies.

The best results were obtained from treatment of the beds, before sowing, with Bordeaux mixture. The formula used was 1·1·10, that is 1 lb. bluestone, 1 lb. lime to 10 gallons of water. Double this strength, that is 1·1·5, was also tried, and while it prevented the mould, it interfered seriously with the germination of the seed.

In addition to this treatment, the conditions under which the plants were grown were varied, in order to see how far the development of the mould was affected thereby. Plants were grown on burnt and unburnt beds, under cheesecloth and glass, also with the usual grass covering, and in a variety of aspects. The experience of last season was, as far as the growth of the plants was concerned, that beds high up in the hills and with a northern aspect gave the best results.

III.—Publications.

Through the medium of the Departmental *Journal* various subjects of general interest to growers have been treated, and the results of many field experiments recorded. The *Fungus Diseases of Stone-fruit Trees,* referred to in the last report, has since been issued, and from the applications made for it from England, America, the Cape, and even Germany and Italy, it seems to have attracted attention far beyond the Commonwealth.

An account of the various rusts which affect our native and cultivated plants has long been required, and so impressed were the members of the various Rust Conferences with the necessity for having reliable data to go upon in connection with the distribution and nature of the different Australian rusts that one of the recommendations invariably made was "Investigations to be carried out regarding all plants that are affected by rusts in the different States." This work has been steadily progressing for a number of years, and now arrangements have been made for its publication.

Since last report the following publications have been issued, and the consecutive numbering is continued.

77. Fungus Diseases of Stone-fruit Trees in Australia and their Treatment. With ten colored Plates and 327 Figures.—Department of Agriculture, Victoria (1902).

78. Black Spot of the Apple, together with Spraying for Fungus Diseases.—Bulletin 3, Department of Agriculture, Victoria (1902).

79. Australian Fungi, New or Unrecorded. Decades I. and II. Proc. Linn. Soc., N.S.W., Sept. (1902).

80. The Micro-fungi of Australian Lobelias.—Victorian Naturalist, Vol. xix., No. 12, 159 (1903).

81. On the so-called Petrified Mushroom—Ibid. Vol. xx, No. 2, 14 (1903).

IV.—Miscellaneous.

A variety of other matters were submitted to me for report, and of these only a few can be noticed here.

The charlock or wild mustard is a troublesome weed in many of our crops, and, although only an annual, it is difficult to eradicate when allowed to seed. It is found that it can be thoroughly destroyed by means of spraying, and this can be done in growing cereal crops without injury. The great point is to spray early, when the charlock is in a soft and tender state, that is soon after the rough leaf appears, and when the crop is perfectly dry. The substance used for spraying is bluestone or sulphate of copper, and a 3 per cent. solution, or at the rate of 3 lbs. to 10 gallons of water is effective. If a thorough spraying is done with 15 lbs. of pure bluestone dissolved in 50 gallons of water per acre, then not only is the charlock destroyed, but the crop generally is improved. Wherever water is available this method can be strongly recommended for the destruction of the weed.

There is another weed which is constantly being referred to on account of its supposed poisonous properties. It is the so-called deadly nightshade, but the name is misleading. The deadly nightshade is *Atropa belladonna*, which does not exist here, while the plant confounded with it is *Solanum nigrum*, one of the commonest weeds in the world, and appropriately named the common or black nightshade. It is well-known that members of this family are often poisonous, and hence they have an evil reputation, but it cannot be certainly affirmed in many instances that they are poisonous until it is experimentally proved. The ripe berries of the plants growing here can be eaten with impunity, and they have a tart agreeable flavour, while a delicious soup can be made from the leaves. The reputed poisonous nature of this plant has not by any means been proved, and it ought to be settled one way or the other experimentally, as was done in the case of the Cape tulip.

The mistletoe on our forest trees has also become a serious pest, destroying much valuable timber, and has been too long allowed to spread without hindrance. As pointed out in the July *Journal*, the only practical way of getting rid of it is to remove the infested branches while the parasite is still young, and thus minimise the evil.

It is an encouraging sign of the times that greater attention is being paid not only to what is grown, but also to the manner in which it is grown; and while Plant Sanitation is being recognised as a necessary study for those who would obtain the best return for their labours, there is also a desire to know the causes that make for disease in order if possible to counteract them.

In the keen competition that now exists, it is only the best that it will pay to produce, and it is just as necessary to attend to the diseases that threaten our crops as it is to apply the best methods in growing them.

REPORT OF THE PRINCIPAL OF THE SCHOOL OF HORTICULTURE.

C. Bogue Luffmann.

Field and Class Work.

The school year has furnished some interesting and very successful work. As pointed out in previous reports, the incomplete nature of the Burnley Estate and the school training ground does not admit of such prompt and straightforward training as is desirable in such an Institution. The place is so deficient in attractions as not to appeal to many who might otherwise be disposed to enrol as students. The reforms of the past year have been extensive and varied, and it is confidently hoped that, within the space of two or three years, every part of the estate will be so planned and endowed with soil as to furnish a thorough training ground for every type of rural producer limited to small areas.

During the year, several acres of otherwise useless land have been covered with corporation rubbish in anticipation of its being converted into true soil. Several acres of the same material in a more advanced stage have been turned over, cleaned and placed under crops, and in part laid down with grass. A considerable length of roadway has been cut and formed, and many blocks of irregularly formed soil properly graded, surface drained, enriched, and planted.

The most important work of the year has taken the form of planning and laying the foundations of such plots of ground as the average orchardist may be called upon to deal with.

The routine work of the estate has at all times been made as informing as possible to the students and visiting public.

Nearly 20 acres are now under fruit trees, vegetables, ornamental plants, and subjects of an economic character. Besides this area, about 10 acres have been made available for the growth of hay and other fodder crops, and the introduction of a few of the most important domestic animals makes the estate complete, so far as variety of subjects and extent are concerned.

In the field the students have taken part in, and been instructed in, the principles of every operation. In ploughing, digging and other means of cultivating and preparing soil, they are generally proficient, whilst the seniors have done excellent work in the pruning and general management of fruit trees. The syllabus for the year shows that no subject of importance is omitted, and that the greatest attention is paid to those which are of most value to the fruit grower of the future.

At the close of the year 1902, a considerable number of women students completed their three years' course and left the School. Since the subject of their admittance has been much debated, it may

be well to furnish a few remarks on the work actually achieved by them, and the value of their efforts. From a State point of view an interesting and inexpensive experiment has been made.

Horticulture in its various forms is one of the most natural outdoor occupations for women, and in the matter of designing and directing garden work, the growing of grapes, lemons, bush fruits and salads, they are placed at no disadvantage with men, providing they possess ordinary health and strength.

Of about 140 women students attending, about 10 per cent. may be said to have thoroughly mastered some branch of profitable horticulture. Another 20 per cent. gained as much experience and habit of work as to make them capable helpers or directors of their own properties. The remainder of the students gave no definite proof of what they may be able to do in the future. A few students are earning a livelihood wholly, or in part, through their experience gained here. Two are engaged in designing and maintaining gardens. One is managing a small mixed estate. One is a writer on horticulture, one or two take pruning contracts, and one has laid out and managed a young orchard of considerable extent in such a business-like manner, as to warrant the assertion, that of its age and character, there is no property to equal it for general excellence in the State of Victoria.

The real and only defect in connection with the training of women in rural pursuits is due to their being non-resident, and devoting but a very small proportion of their time to the work. In the circumstances, the result of local effort must be regarded as very satisfactory.

In Great Britain, Germany, Austria, France and America, women are rapidly improving their position in the orchard and garden, but they devote their whole energies to the work, and shirk no form of drudgery which may lead to the possession of useful knowledge.

In Victoria, life is not so hard for the many as to invoke a splendid earnestness, with the result, that women will not be found in large numbers imitating their sisters in older communities, till they are forced by the stern arm of necessity.

Excepting the women students, the roll for the year has not been large, but the type of student has been very satisfactory, and there is every prospect of our turning out a few really good men. The greatest muster of male students during the year was 17. A few women students (who now pay like the males a fee of £5 per annum) have attended, and made very good progress.

In the quarterly and final examinations some excellent papers and essays were furnished, the majority of the students showing a good working acquaintance with the subjects in which they have been instructed.

The instruction of the visiting public involves no small amount of time on the part of those who are competent to give advice. There is a steady stream of interested visitors the year round, but at holiday

and "show" seasons scores come in a single day. The advantage of the site as a training and demonstration ground comes into prominence at such seasons, since all roads leading to Melbourne, the largest possible number have the opportunity of seeing on what lines we are working. The number of visitors during the year may be set down as slightly under one thousand.

Demonstration Orchards in Country Districts.

Six small demonstration orchards were formed and planted during the winter of 1902, and each has since received such seasonable attention as would secure the best type of growth under a given set of conditions.

The object is to provide a fair local example of how soil should be cleaned, deepened, drained, enriched and thrown into surface form appropriate to local resources and phenomena. The selection of species and varieties of fruit trees, their shaping, mode of planting and general care, has also been in accord with the demands of local soil and climate.

Victoria is so large as to provide several distinct climatic zones, thus causing the most valuable commercial fruits to fall into groups, each more or less suited to different regions. Hence, with but a limited amount of capital, it was found necessary to establish but six stations in widely dissimilar climates and soils. Horsham, Rutherglen, Castlemaine, Portland, Healesville, and Drouin, furnish most marked contrasts, and at the same time represent a set of conditions typical of considerable extents of country.

The sites chosen embraced virgin soil and old orchard land, also some extremely dirty, and other practically clean and prepared soil. But in no instance was extra good land chosen—since these demonstration orchards are not intended as experiments but as actual working examples, so far as uniform conditions and material obtain. In one or two instances the land chosen was below the average of the locality, since advantages of site and means for visiting and working economically had to be taken into consideration.

The work during the year has of necessity consisted of laying a solid foundation for, and planting and caring for, the young trees. Fallowing—so necessary to most newly cleared bush land—was not in any case strictly necessary, since all the sites had been more or less exposed for some years. The work, therefore, comprised clearing out and burning all kinds of rubbish, several ploughings, and grading the surface so as to equalise the depth and quality of the soil, and to ensure surface drainage, sub-soiling wherever the loose weathered soil was less than nine inches in depth, providing for surface or under drainage, according to circumstances, liming all the land at the rate of 30 cwt. per acre, getting together manure and well spent litter to provide a free and mellow body of earth on the planting sites, and afterwards throwing the surface into bold ridges previous to planting.

Both one and two-year-old budded trees were selected and planted. Some trees were set out in midwinter, others in early, and again in late spring, and with rare exceptions there are no visible differences in vigour and quality of growth.

In nearly all cases, the trees have as a whole grown extremely well. At Horsham, which was laid out for, and supplied with trees demanding irrigation, a temporary failure has resulted, owing to the Wartook water supply failing absolutely during the summer 1902-3; but in all other instances there is scarcely a dead or defective tree to be recorded.

Points which may be regarded as novel in connection with these demonstration grounds are :—

(a) Deepening the soil on the planting lines by means of ploughing two or three times one way, and then piling the actual soil in a series of ridges, leaving the furrows practically bare of true soil.

(b) Bringing in large bodies of additional soil wherever the planting site is shallow and poorly endowed.

(c) Liming before planting.

(d) Manuring the young orchard. It is commonly stated that young trees need no manure, but this is a short-sighted crib from the old country, where soils are richer and the climate more genial. Manure holds moisture, and for this reason, if for no other, it is of great assistance to young trees, though of course it must be in a spent and mould-like condition when applied near the roots.

(e) The close pruning and regulating of roots to ensure a few mains, as against many fibrous, has been a point of interest.

(f) The bandaging of all trunks to prevent burning of the bark by the sun, has led to much discussion on the part of those attending.

All the important operations have been duly announced in each locality, and carried out under the public eye. The six stations have been visited on an average of four times during the year, and as two or three addresses and lessons have been given on each occasion, between 50 and 60 in all have to be reported in connection therewith.

The work has been watched with great interest, and large audiences have invariably attended. The masters of State Schools have frequently brought their senior pupils, and at Portland and Healesville, no fewer than three schools have been represented the same day.

Laying the foundation of an orchard is the State teachers,' as it is the private growers' chief concern, and when after another year or two the already made orchards are provided with well formed and established trees, it will be possible to hand the work over to the actual owners, and for the State servant to demonstrate on new fields.

Lectures and Field Instruction to Rural Producers.

About 56 Lectures and Field Lessons were given under this heading during the year.

The subjects were of necessity limited, since the common wants in all localities are much the same. The lectures and lessons have, therefore, been on the principles and advantages of deepening, enriching, draining and more systematic cultivation of orchard lands; and the planning, planting, pruning and general management of fruiting trees and plants.

These lectures and lessons have on all occasions drawn considerable audiences, averaging about 40 or 2,240 for the year.

Field instruction is unquestionably of most assistance to the adult working student. He can, as a rule, learn only from seeing the work performed. He is more than half sceptical of methods other than his own, but with verbal explanations supported by practical demonstration, he can, if the teaching is sound, learn in spite of himself.

Special Courses of Lectures in Melbourne and Suburbs.

During the year three separate courses of ten lectures each, have been given at the Working Men's College, Melbourne; the subjects comprising those most essential to the choosing, preparation and management of small rural estates.

Several lectures were also given before various Horticultural Societies, the Australian Natives' Association, and other organised bodies.

Correspondence.

The amount of information given to rural producers through this channel is very considerable, since, from 1,000 to 1,200 letters have been replied to during the past year. The nature of the enquiries renders it necessary to supply an autograph letter in each case. It is unfortunate that the pith of these communications cannot be systematically preserved and given to the public, but it not infrequently happens that the replies to correspondence are given to the country press, and in this way more than an individual may benefit.

It may be well to suggest here that nothing but good could result from a concerted plan being adopted whereby all replies by the Department's officers on technical and cultural subjects be marked for transference to the local editor.

REPORT OF THE INSPECTOR OF RURAL INDUSTRIES.

J. Knight.

Inspection of Exported Products.

During the past few years a system of inspection of farm produce has been adopted, and certificates are given for all produce up to the recognised standard of quality and condition. This originated from the War Office authorities requesting the Department to look to the fulfilment of the conditions of the contracts entered into by State merchants for supplies to the army. From this it has extended to private shipments, the inspection being made free of cost. But, during the last year, a minimum charge of one shilling has been made, and one shilling per hour for all inspections extending over one hour, and this appears to work satisfactorily. Mr. Gamble, who has charge of the office, and is also responsible during my absence, attends to this portion of the work. It is needless to say that this entails the keeping of records of accounts and all shipments made, also supplying reliable information to the Department as to the nature and extent of exports, and arranging for inspections to be made from time to time. The importance of this may be shown by the number of certificates issued for the past twelve months, viz.: 3,261.

I may also point out that this office has been approached with a view to dealing with the wheat exports. Many of the large firms consider that the quality and standard of the products shipped should be shown on a Government certificate; and, further, where cereals are purchased from various parts of the State, that the onus of rejection in fairness to both shipper and producer should rest with an authorised sampler, who should be under the control of the Department. I see no reason why this should not be done on the same principle as the inspections now made for export.

It is the practice in other ports to protect the merchants in this way, and if such a system could be worked out here there is no doubt it would tend to improve the status of our products and assist materially in developing a healthy export trade, which would be to the advantage of our farmers, as much of the grain sent forward for shipment is not of standard quality.

Inspections under Bonus Regulations.

This work of inspection has decreased considerably during the last year, and may be said to be confined to flax growing, fibre production, and broom corn. This falling off is due to a large extent to the high prices ruling for ordinary farm products.

Unfortunately, intermittent supplies tend to affect the market for these products, and the trade are unable to put reliance on the

local supply, and have to seek outside markets. This has the effect of reducing the price of some of these products when the local supplies are available. There is no doubt that when the production of these are better understood, and the seasons return to their normal conditions, more attention will be paid to those products which are now overlooked.

Correspondence.

A large amount of correspondence is received asking for information relating to practical farm and orchard work, and this has been given due consideration by myself and assistants. The personal applications which are made at my office trespass considerably upon my time, but this method of supplying information is preferable, as more definite instructions can be given than by answering bald questions from correspondents.

It has now become generally known that information of this nature can be supplied, and the public appear to avail themselves of the privilege freely. It is desirable to encourage this, as frequently people rush into matters with imperfect knowledge, only to meet with disappointment.

Exhibits at Country Shows.

It has been the practice for some years to attend the Country Agricultural Shows, with the object of displaying the various agricultural products the growth of which it is desirable to encourage. For this purpose a large marquee has been purchased, and special products of all kind are exhibited in the different stages of manufacture. This work has increased to a considerable extent, and the demand has been so great that a duplicate set had to be secured to comply with the numerous requests for exhibition. These exhibits are known as No. 1 and No. 2. No. 1 exhibit consists of a large marquee, fitted with tables and appliances for displaying the exhibits to the best advantage. Collections from the various branches of the Department are shown, consisting of vegetable products of a special and general character, such as cereals, grasses, fibres, oils (fixed and essential), fruits preserved in various forms, seeds of all kinds, and extensive exhibits from Dookie Agricultural College, showing the products of the farm. A portion of the marquee is occupied by Mr. Crowe's branch, which makes an excellent display of the animal products, consisting of poultry, eggs, rabbits, etc. Specimens are shown from the Entomologist's branch, from the Vegetable Pathologist's branch, and also from the Agricultural Laboratory. The exhibits are attended to chiefly by Mr. Robilliard, who is engaged giving information on the various products during the currency of the show. Mr. Crowe's branch is represented by Mr. Hart, or one of his assistants, who gives practical demonstrations on the most approved methods of dealing with the products exhibited.

No. 2 exhibit is a duplicate set, but without marquee or tables, and Societies accepting this are called upon to provide tables and covering. This exhibit is usually attended to by Mr. Gamble, who is

frequently called upon to leave the office and attend to this work, giving information when inquiry is made, and explaining the main features of the exhibit.

It has been the practice to forward these exhibits free on application of the Society, but during the current year a new order has been established, a charge being made to cover railway transit and this, possibly, will lessen the demand for these exhibits. I think it is my duty to point out that, whilst it may be desirable to charge in most cases, it is, nevertheless, a hardship on small societies situated at a distance from the chief centres of population, as the residents of these districts are unable to obtain information on such matters which is available in more settled districts. Since these exhibits are taken for educational purposes, in my opinion, some concessions should be made to these distant places. The following centres have been attended during the past year:—Melbourne (Royal Show), Geelong, Wangaratta, Yarrawonga, Benalla, Nhill, Sale, Bairnsdale, Kyneton, Mansfield, Kilmore, Cobram, Charlton, Echuca, Seymour, Yarram, Traralgon, Birregurra, Cheltenham, Shepparton, Korumburra, Leongatha, Romsey, Warragul, Tallangatta, Yackandandah, Oakleigh, Ringwood, Box Hill, Somerville, Pakenham, and Castlemaine.

Lecturing.

This has received attention during the past year by myself and Mr. Robilliard.

The subjects dealt with have been of a general character, bearing upon the cultivation of ordinary and special products, but I regret to say the many calls upon my time debar me from giving more attention to this class of useful work.

The usual practice adopted is to attend the various places requesting lectures, and to give practical demonstrations in the field where an opportunity offers, and to lecture in the evening with the aid of lime-light illustrations. This appears to meet the wishes of the community and to give general satisfaction.

Several lectures have also been given at the request of State School teachers. The method adopted is to take a number of specimens of products similar to those exhibited by the Department at country shows, and their nature, method of cultivation, and value are described. In some cases illustrated lectures are given by aid of lime-light views during the evening; this I consider a very desirable work and one that should be extended, especially in country districts, as it impresses upon the youths the importance of matters which are of daily interest to them.

Flax Seed.

Some few years ago the Agricultural Department imported some of the principal varieties of flax grown in Europe, one of which is known as the White-flowering Belgian. This is an early or spring variety, and matures its seed some two or three weeks earlier than the so-called Winter flax. This seed has become neglected, and it was

thought desirable to purchase a few bags and distribute it, with instructions as to its treatment. This has been done with the result that upwards of fifty applicants have received seed, varying from 2 lbs. to 8 bushels each, on condition that an equal quantity of seed was to be returned after harvest. This condition has been fulfilled, and the returned seed is being distributed to applicants. This work has been followed up by giving advice as to manipulating the crop for fibre and oil-production. The beneficial effects of this cannot be doubted as flax, when its cultivation is properly understood, must take its place amongst ordinary farm products.

Flax Machinery.

As the treatment of flax for fibre making purposes is not generally understood, it was thought desirable to send around machinery to the different growers who wished to obtain full information as to the treatment of this valuable product.

This has been done, the plant consists of an oil-engine, kindly lent by Messrs. Bennie, Teare and Co., breaker, a pair of scutchers, and a roller or boll-crusher, generally described as a thresher, the last three mentioned kindly lent by Messrs. Cliff and Bunting. This may be regarded as all the necessrry machinery required for the treatment of flax.

Mr. Robilliard and myself have been engaged in giving instruction in retting, a process which extends over three or four weeks, and also in preparing fibre for market, and it is pleasing to note that great interest has been taken in this work. The machinery is now working at Yinnar in the Gippsland district, and here may be seen a farmer with his family of boys preparing fibre most successfully. The value of instruction of this kind cannot be over estimated, as its practical nature leaves no doubt whatever as to what can be done in the way of fibre production. There are several applications for this machinery from growers. In some cases the flax straw has been prepared under the direction and supervision of the officers of this branch.

It is pleasing to note, also, that the flax produced by this travelling plant has given satisfaction to the purchaser, who speaks in the highest terms of its quality. I think it desirable to mention this, in order to show that the extraction of fibre does not require a long apprenticeship.

Distribution of Seeds.

During the past year many enquiries have been made for agricultural seeds. This, no doubt, is attributable to the severe drought experienced, and the necessity for providing fodder for starving stock. Large quantities of millets and sorghums of all available kinds, salt-bush, etc., have been sent out to various localities.

A quantity of Egyptian Clover seed was imported last year by the Department. This has been delivered free on application, with the result that 455 parcels of 1 lb. each were forwarded for trial in

various parts of the State. Favourable reports are now being received as to its suitability in different districts, but the season is not advanced sufficiently to give definite information as regards its value as a fodder plant. So far it has shown a quality worthy of notice, viz., its winter growth. Some doubt arose as to the advisability of sowing the seed in consequence of it being mixed with a so-called weed, but this plant also may be regarded as a useful forage plant, and appears to belong to the chicory family, but nothing definite can be said until both plants have matured their season's growth.

A quantity of seed wheat has been distributed from this office, varying from 1 lb. to 5 bushels per applicant. All seed distributed by this branch has been carefully cleaned before being sent out.

The varieties consist of Bluestem, Barletta Hard, Defiance, Haynes' Pedigree, Marshall's No. 3., Purple Straw, Club Head, Dart's Imperial, Early Para. These wheats are all imported from California, Manitoba, Argentine, and South Australia.

State School Plot System.

Some short time ago an effort was made to have experimental plots in or adjacent to the State School Reserves. A few of these were attended and advice given, but from some cause have not been persevered with.

As no great amount of expenditure is necessary, I think this is a matter for regret, as the value of practical illustrations must have effect not only on the children but also on the parents and others in the locality.

Many of the special products may be cultivated in a small way, which would not only familiarise the students but also serve in a manner to show what may be done in the varying conditons of climate and soil.

Attention to Visitors.

Visitors from outside the State have to share the attention of the Department, and, in some cases, trips have to be taken throughout the country districts in order to show the various operations carried on. As in the recent visit of the Boer delegates, Russian envoy, and others, they also require statistical and general information bearing upon the agricultural industries of the State.

Agricultural Exhibits for London.

It has been the practice for a considerable time to collect exhibits of the products of Victoria for exhibition in the Agent-General's office. Several requests have been made for a duplicate set of exhibits to travel around the provincial shows of Great Britain.

This has been complied with, to a limited extent only, during the year. This is attributable to the unfavorable conditions of the season for nearly all farm products. This work is one which should receive more attention than my time permits me to give to it.

If it is desirable to exhibit throughout Great Britain, and there can be no doubt as to the advantage of so doing, then our best products only should be sent, and every care taken that nothing is forwarded which may tend to prejudice the outside public against our produce.

It is my intention to supplement those already sent forward with such products as were not procurable prior to the despatch of the last consignment, but if this work is to be carried on efficiently, some provision must be made for securing these exhibits as opportunity permits, either by purchase or otherwise.

The following products have been sent forward :—Compressed Fodder, Chaff, Hay, Wheat, Oats, Flour, Barley, Wool, Preserved Fruit in jars, Dried Fruits, Jams, Raspberry Pulp, Honey, Preserved Meats, Tobacco, Wines, Flax, Straw, Seed, and Maize in cob, and grain.

Exhibits for South Africa.

A small collection has also been forwarded to Mr. Hunter in South Africa, but I regret to say that in consequence of the extremely unfavorable season I have been unable to do justice to this, but if that office is to receive attention further exhibits can be supplied during the approaching season. Most of the exhibits have been supplied by the trade, and have been packed and shipped by this office.

The following is a list of articles forwarded :—Compressed Fodder, Chaff, samples of different varieties of Wheat in ear and grain, Barley, Oats, Flax Fibre, Straw, and Seed, Tobacco Leaf, Wines and Brandy, Dried Fruits, Jams, Preserved Meats, Butter, Honey, Sauces, Machinery and Implements.

Advising re Machinery.

I have frequently been called upon to advise as to the purchase of machinery for agricultural purposes outside the State. Whilst this is not directly connected with my duties, it is nevertheless necessary that the work should be attended to and carefully carried out.

The immense strides made in the improvement of agricultural implements and machinery makes its necessary that careful attention be given, so that the advice will not reflect hereafter on the Department.

The export of farm implements to South Africa and other countries is considerable.

Office Duties.

In carrying out the various duties referred to, it has been found that frequently office work has to fall in arrears in consequence of the demand made for information which necessitates the whole staff leaving the office; but the inspectors, who are paid by the hour, are generally called in to attend in the absence of Mr. Gamble. I regret to say I have no means of compensating these inspectors

for the time taken up in this respect, and, should this class of work continue to increase, it will be necessary to make some provision for this. The number of callers seeking information on various subjects are increasing considerably, and unless due attention is given to their wants dissatisfaction will result.

The collection of exhibits for the various places referred to has also received attention in collecting, preserving, and mounting specimens, which engages the time of myself and staff in the intervals. The staff consists of myself, Mr. Robilliard, and Mr. Gamble, with temporary inspectors, who are called in as required, and are paid per hour by the applicants requesting inspectors.

REPORT OF THE INSPECTOR OF FOODS FOR EXPORT.

A. A. Brown, M.B., B.S.

Frozen Meat, &c.

The volume of meat exportations for the year will come perhaps as a surprise, when we consider that the disastrous drought only broke up generally in April last. The effects of the drought were keenly felt in the Riverina, which had always been regarded as the chief centre from which Victorian exporters drew their supplies. During the season 1901-2, the mutton and lamb that came from that district, as well as much of that from our own State, arrived in Melbourne in very backward condition. As a matter of fact, through the adverse seasonal influences, the lambs never had a chance of getting fat, and whatever condition sheep may have gained during more favourable periods was lost when the pastures began to get bare.

In the season of 1901-2, the average weight of lambs exported was about 29 lbs., and of mutton 37 lbs.; but in 1902-3, the average weights were about 32 lbs. for lambs, and for mutton 42 lbs.

In consequence of the severity of the drought in the Riverina very little of the supplies for export in the past year came from that district, the supplies being practically drawn from within our own State. At the outset of the season prices for stock ruled firm, but as the summer advanced and feed and water began to get scarce, graziers were afraid of being overstocked, so prices relaxed, and exporters entered the field. In some cases even the ewes, that should have been kept for breeding purposes, had to be disposed of, so terrible were the straits to which some graziers were reduced.

African, British, Mediterranean, China and other Eastern markets were exploited, and the prices realised have been very satisfactory to our merchants. With the East there is every prospect of a steady trade during the whole year being maintained. London prices last season for lamb were :—Prime 5¾d., seconds 5d.; Mutton, prime, 4½d., seconds 4d. per lb. In consequence of extended and careful methods of inspection by Messrs. Lowe and Peppard in the Metropolitan area and Geelong, and Mr. Terry in the Western District, I have no hesitation in saying that the quality of the meat passed for export left no room for criticism.

Large numbers of sheep from the Riverina and from the Wimmera were canned last year. Owners were forced to part with the stock to preservers, as no water or grass existed on the stations from which they came. Canning operations in the metropolitan area have become somewhat extensive, and the efforts of Messrs. Peppard, Lowe and myself in condemning inferior commodities have brought about recognition that stringent inspection during and after canning

operations has done much to put the export of canned rabbit particularly and other goods on a sound basis. The strict inspection of canned goods is an absolute necessity if we wish to preserve this rather extensive and promising industry. It affords considerable employment to many people, and the meat used for the purpose of canning would not be suitable for export in the carcase, as it is of a quality which would not do justice to our frozen meat trade. As a matter of fact, it is meat from fairly nourished but small carcases. In some seasons there are unlimited supplies of this, and the proper inspection of the works at which the meat is canned must be carried on, so as to promote assurance in the minds of consumers abroad, that the Government will not allow exportation from the State of any product of doubtful soundness. In previous reports I have drawn attention to the fact, that during the hot summer months the canning of rabbits should be stopped, as the flesh is prone to rapid decay.

The outlook for the canning season is decidely encouraging, and the freezing accommodation of the State will be sorely taxed to keep abreast of the business. The coming season, in all probability, will be a prodigious one, and graziers will have to dispose of their stock as cash will be wanted after the bad times that have been encountered. Independently of London and Africa, markets already exist in the Mediterranean and the East for our meats. The naval and military stations in the East are likely to absorb large quantities from Victoria, but I am afraid the freezing space will not exist to treat all the stock that will be offering. In England large quantities of our meats find their way into the military stations, and the authorities now require each carcase to have a tag attached certifying to its inspection.

Only about half the number of carcases of lamb were exported during the season, but twice as many carcases of mutton as compared with the previous one. The differences can be explained when we view the seasons. Last season the lambs perished from drought; the previous season they were hurried from the pastures to avoid it. Last season ewes and wethers were parted with to the exporters to save them from perishing from want of food. Notwithstanding the shortage of veal, beef, and pork, for local trade purposes, exporters found it profitable to send away considerable quantities last year. The veal and pork killed on the farms should, as I have recommended in previous reports, be properly bled and dressed, and sent to the Melbourne markets in cheesecloth or hessian bags.

The trade in frozen rabbits is increasing rapidly. Trappers would do well to follow out all my recommendations in the pamphlet published by the Department on "Hints to Rabbit Trappers." They would save considerable loss if the directions were faithfully fulfilled. Every year thousands upon thousands of rabbits are condemned as unfit for food through seasonal influences and carelessness on the part of trappers.

The poultry export still maintains its vigour, but in consequence of the high price of feed prevailing last season, the birds did not come into the markets in that excellent condition noticeable in previous

seasons. The export of poultry is surrounded with many risks, and only in seasons when feed is cheap can we expect to successfully compete with America and Europe in the African and English markets.

The returns printed under the heading of Statistics, indicate a decidedly healthy trade in canned meat goods.

Bones and Bonemeal.

In connection with the regulations framed with the object of preventing bones, bonedust and bonemeal from being introduced into Victoria from countries infested with anthrax, unless certain conditions are fulfilled, I have to say that a careful inspection of the commodities had to be made from time to time, and the works to which such were conveyed had to be periodically visited.

The table indicates the quantities imported into Victoria from January 1st to June 30th last, and the commodities exported indicate such as required certification, before the States to which such were sent allowed its introduction.

IMPORTS AND EXPORTS OF BONES, BONEDUST, ETC., FROM JANUARY 1ST TO JUNE 30TH, 1903.

	Imports.	Exports.
	Bags.	Bags.
Bones	4,098	—
Bonedust	6,049	11,120
Bonemeal	3,000	1,554
Superphosphate	—	1,300

Diseases of Animals.

Many outbreaks of infectious diseases amongst stock during the past twelve months have occurred, and if a wet spring sets in, as prospects indicate, certain maladies are to be apprehended, and steps should be taken to minimise their evil effects. Disorders dependent on parasite invasion require notice, as it is in wet seasons they cause exceptional troubles.

SWINE PLAGUE.

Swine plague has been causing much concern to our producers. It has been the cause of considerable mortality in our pigs. Some years ago it, no doubt, made its presence felt in Gippsland, but, in consequence of not getting fresh specimens at that time, I then could not do more than give a provisional diagnosis. I then announced that the disease might turn out to be swine plague.

On March 20th last, I had an opportunity of seeing a case from which I made pure cultures of the germ which causes the disease. I announced the condition to be swine plague, and since then numerous cases have come under my notice. I was the first to definitely determine its existence in the State.

Fowl Tick.

Fowl tick is still a source of great trouble to our Northern and Mallee farmers, but the efforts of Inspector Smith and the police officers, who are dealing with this pest, have served to keep it in check. It is still confined to the districts in which I first found it, and every effort should be put forth to prevent its getting beyond control. By the judicious exercise of quarantine regulations, the tick can be restricted to certain districts. When the railway to Mildura is opened it will be necessary to place that district under quarantine.

Its appearance early in 1903 was reported at Lubeck and Murtoa, but prompt measures led to its eradication from those places. It is at Hopetoun, but it is hoped that it will soon be exterminated there. The outbreaks at Lubeck and Murtoa were traced to birds coming from Adelaide, and it behoves the Department to be extremely careful in preventing it from gaining a footing in Melbourne. The restrictions placed on birds coming from New South Wales and South Australia, and from our own quarantined districts have certainly saved Melbourne from invasion. During the year experiments were conducted with cultures of moulds *(Penicillum glaucum* and *Mucor ramosus)* to see if a disease could be spread through the ticks. I sent up pure cultures to Mr. Smith with directions how to use them, and he reported that the *Mucor ramosus* did kill the ticks but in consequence of the dryness of the season the disease did not spread. Moulds flourish in damp cool districts, and if seasons to come are favourable, our efforts may be crowned with success. I intend prosecuting experiments in this direction with cultures of other moulds as well as those already mentioned. To my mind, this is the direction in which success is to be expected in exterminating the tick.

The following table furnishes particulars of the poultry inspected since the beginning of January this year in connection with the fowl tick outbreak, and indicates the extent of the supervision exercised in Melbourne over birds arriving from all parts of the State. Nearly all the birds examined passed through the auction rooms of the city, and a fair idea of the poultry trade of Melbourne can be obtained from the figures.

Poultry Examined in the Metropolitan Area by Inspector Lowe, from January 1st to June 30th, 1903.

Kind of Poultry.	Inspected Head.	Passed Head.	Condemned Head.
Fowls	167,885	167,650	235
Ducks	26,919	26,919	—
Turkeys	17,766	17,758	8
Geese	3,497	3,497	—
Pigeons	1,175	1,175	—
Quail	60	60	—
Guinea Fowls	5	5	—

REPORT OF THE POULTRY EXPERT.

A. Hart.

The Export of Poultry.

In presenting the Annual Report in connection with the poultry and egg industry, I might mention that the past season has not been so prosperous as could have been wished. This may be ascribed to various causes. The severe drought throughout the greater portion of Victoria has certainly been against the advancement of the poultry industry. High prices for grain, and the great clearance of stocks on account of farmers all through the Mallee and northern districts having to leave their holdings, has caused a very large reduction in the number of chickens reared during the past season, and the former point has also tended to bring down the general condition of the young stock which were reared. This fact accounts for the increase of rejects this year in the consignments of poultry sent in to the Government Cool Stores, and the industry has suffered through this cause. The export trade still offers an almost unlimited demand for table poultry. South Africa absorbed by far the greater portion of the poultry exported last year. This market is not likely to increase, but no doubt a considerable quantity will still be required. The United Kingdom is available for the supply of large quantities of table poultry of a suitable grade. The British Board of Trade returns for the past year show a record total of imports of poultry and eggs into Great Britain during 1902. For that year £6,299,934 worth of eggs and £1,059,000 worth of poultry and game were imported, as compared with eggs, £5,495,776, and poultry and game, £980,739 in 1901. The total increase of imports during 1902 over 1901 amounted to no less than £882,419. The total numbers of eggs imported from foreign countries during the past four years increased from 1,940,921,200 to 2,271,661,560. The expenditure on these eggs was equal to 16s. 10½d. per family in Great Britain. Russia, Germany, Denmark, Belgium, France and Canada were the principal countries which contributed to this supply. It is estimated that the total number of eggs consumed in Great Britain last year was 4,300,000,000, or about 115 per head for the whole of the population.

The foregoing figures will illustrate how extensive is the demand for both poultry and eggs in Great Britain, and there is at present no possibility of the supply being too great for requirements. Victoria should endeavour to participate in the large sum annually distributed, and there is no reason why we should not be able to compete successfully with the other countries in the supply of both eggs and poultry to the British markets. The past shipments of both products have proved in every way successful, and they are held in high estimation by consumers, and also realise top prices. The demand for poultry

and eggs last season was in excess of the supply, and Victorian representatives had to go to other States to fill the balance of orders received here. Other outside exporters filled their poultry orders with birds which were of indifferent quality, and did not carry the Government stamp. This was brought about by the short supply of good conditioned birds of the grade necessary to secure the Government stamp.

During the past year, about 50,000 head of poultry were killed, dressed, graded and frozen in the Government Cool Stores. This number contained none but birds in first-class condition, comprising chickens, ducklings, turkeys and geese. The greater portion of these birds were sent to the South African market, and the demand was exceedingly brisk. The falling off in the number of poultry put through may be set down to the severe drought, which limited the supply, and also caused exporters to go to the other States to fill their orders.

In former years the freight on packages of frozen poultry consigned to Great Britain was very high, running into 1s. per bird, but, owing to the extension of the export trade, and other improvements in economising packing, etc., this has been considerably reduced. Packages now sent contain 520 chickens to the ton measurement, the freight on which is 45s., being slightly over 2d. per pair. This great reduction of freight should be the means of developing and encouraging the export of poultry to Great Britain, and presents very favourable inducements to the farmer and producer. The outlook is at present very promising. There appears every prospect of a good season right throughout the State, and, should the present conditions continue, we may expect a plentiful harvest and payable results in poultry keeping.

The best time for exporting so as to command highest prices for chickens or ducklings, is to land in England from March to June. Turkeys should be sent during September and October, and must be on the London market before Christmas. Either turkeys, chickens or ducklings can be killed when they are in prime condition, and can be kept in cool chambers until they are required for exportation. The weight of turkey gobblers should be from 12 to 20 lbs., and the heavy weights are in most demand, providing the condition is up to the mark. Turkey hens should range from 7 to 10 lbs., and no birds should be over 12 months. Chickens should be from 2½ lbs. to 4 lbs., and their age should be from 14 to 20 weeks. Ducklings should run from 4 lbs. to 5 lbs., and age should not be more than 10 to 12 weeks. All weights given are for live birds. One point which must be observed is to send nothing but first-class conditioned birds. Liberal feeding will encourage weight, and the sooner that birds are ready for the market, the less the expense and trouble of feeding will be. Birds intended for export should be put up and fed with suitable food so as to induce both growth and condition, and this applies equally in the case of turkeys as well as chickens and ducklings.

Exporting and Storing Eggs.

The British markets still offer practically an unlimited demand for eggs, but, owing to the requirements for local consumption, there was no surplus for exportation this season beyond Inter-State and South African consignments. The latter were, however, a failure, as the bulk of the consignments were badly selected and packed, and also sent as ordinary cargo, no cool storage being available. During the past season 100,000 dozen eggs were put through the Government Cool Stores, and with very satisfactory results. The eggs were placed in the chamber when their market value was from 8d. to 1s. per dozen. The extreme scarcity of new laid eggs during the first four months of this year caused an increased demand for the cold storage stocks, and the satisfactory way in which these eggs turned out caused keen competition and increased prices. A word of praise is due to the chief engineer, Mr. Lennox, who kept the temperature correctly during the eight months the eggs were in store, which materially conduced to their success.

The average price realised for the eggs put through cool storage would be about 1s. 4d. per dozen. This represents a commercial value of £6,666. Their value at the time they were put in was £4,166. This, after deducting expenses of cool storage, 1½d. per dozen for six months, leaves an extra profit of £1,875 to the farmer and producer. The success of keeping eggs by cool storage is now assured, and this must undoubtedly be the means of creating an increased consumption. At any time of the year the consumer can rely on getting an article which for table purposes is quite equal to a new-laid egg as far as freshness is concerned. The perfecting of this process must be credited to the Department, for, although several outside firms during the past ten years had given this system of keeping eggs a trial, none of them were successful, and it was not until the Department took it up that success was attained. During the past season a large number of farmers and storekeepers took advantage of the inducements offered by the Department, and, despite the unfavourable season, the quantity of eggs stored was a considerable increase over last year's total.

There is one point which must be observed in storing eggs, and that is the careful selection of perfectly fresh eggs for this purpose. If stale eggs are put in, they cannot be expected to come out in good condition, but, if fresh and sound, eggs will come out in exactly the same condition as when they were placed in the store. Eggs should also be perfectly clean, and should be gathered two or three times a day if required. They should not be washed unless they really need it. The provision of clean and suitable nests will be the best method of saving their washing. Since the Department instituted demonstrations at shows throughout the country districts, it is pleasing to note that there has been a great improvement in the cleanliness and packing of eggs sent in to market. In the past, musty chaff, red sawdust, and bad packing, together with the use of dirty and unsuitable boxes, could often be noticed, but these faults have now almost

disappeared. The producers have taken notice of the object lessons placed before them, and the result is very creditable, both to the producer and the Department. The egg filler, lined with tasteless paper, brought out by the Department to suit any box similar to kerosene cases, is now becoming universally popular. Its cost is only trifling, being 7½d. for the box. This will allow 25 dozen eggs to be securely packed, and kept free from taint of any kind, and it should certainly be recommended as the best method of packing for cool storage.

Although the past season has been a very prosperous one as regards the storage of eggs, it cannot be expected that this state of things will continue in the future, unless attention is directed to foreign markets. The egg production of Victoria will no doubt increase, and this will necessitate the exportation of our surplus to other colonies. To compete successfully in exporting eggs to foreign markets, it must be borne in mind that the different points in connection with this industry must receive special attention. The introduction of cool storage chambers on shipboard would be conducive to success. Trouble may even then arise through one producer not being able to take up the amount of space offered by the shipowners. A full chamber is the smallest space that will be allotted, which may be too large for one exporter. This might be got over by the Department securing a full chamber, and then allotting space according to the requirements of shippers. No trouble should be experienced in making this arrangement, and the Department would suffer no loss whatever. This would also be the means of assisting and developing the egg trade between Victoria and South Africa, United Kingdom, etc.

The great benefit to be derived from cool storage would be the regulation of prices. No glutted markets would give the middleman the chance he has had in the past, and the producer can always rely on securing the best market value for his products.

Poultry Classes.

The Poultry Classes, which were given under the guidance of the Director of Agriculture, were well attended, and it was gratifying to find so much interest taken in the valuable object lessons afforded by this means. During the past year demonstrations and lectures were given at the most important agricultural shows throughout the State, and great interest was evinced in the various phases of the work. The whole of the different branches were thoroughly explained, including the best and latest improved methods of killing, dressing and marketing the poultry. Full explanation was also given as to the best breeds and crosses of poultry for table or egg production; and care, feeding and attention to the stock was also dealt with. Exhibits of the different breeds of poultry suitable for export and egg production were shown alive and dead, and samples of grain, meal, shell and grit suitable to the requirements of poultry were also included. Models of troughs, dustbaths and all other appliances of the latest approved

patterns for insuring successful poultry keeping, formed a special feature in the collection.

Imported Birds.

During the past year several shipments of pure bred poultry have been imported from Great Britain and other countries. According to the provisions of the Stock Branch, all of these birds were carefully inspected by me, and only one case of disease was found. In this case the birds were placed in quarantine, and they died within 14 days after landing. This proves the necessity for a careful inspection of all birds sent in from other colonies so as to prevent the introduction of contagious diseases through infected stock.

RAINFALL IN VICTORIA.

MONTHS OF JUNE AND JULY, 1903.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in June, 1903.	Average rainfall for each Area for the month of June based on all previous years of record.	Maximum fall recorded within each Area during June, 1903.	Actual Average rainfall recorded in each Area in July 1903.	Average rainfall for each area for the month of July, based on all previous years of record.	Maximum fall recorded within each area during July, 1903.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	1·45	1·71	1·93 at Beulah	1·53	1·25	1·93 at Rainbow
B	2·17	2·43	3·91 ,, Apsley	2·34	2·01	3·49 ,, Apsley
C	3·26	3·44	4·51 ,, Panmure	4·35	3·12	4·89 ,, Panmure
D	3·90	4·31	5·59 ,, Pt. Campbell	4·13	4·00	4·56 ,, Port Campbell
E	1·56	1·98	2·28 ,, Charlton	2·35	1·34	3·66 ,, Charlton
F	3·08	2·83	4·04 ,, Benalla	2·48	2·19	3·37 ,, Benalla
F_1	3·29	3·23	4·07 ,, Avenel	2·95	2·54	3·66 ,, Alexandra
F_2	4·71	4·97	5·83 ,, Yack'dandah	4·58	4·04	5·69 ,, Yackandandah
G	3·19	2·93	4·05 ,, Yandoit	4·14	2·19	4·42 ,, Bendigo
H	3·62	3·77	4·68 ,, Daylesford	4·03	3·02	4·93 ,, Daylesford
I	2·06	2·62	3·34 ,, Melbourne	1·82	2·36	2·89 ,, Ballan
I^1	3·75	3·53	3·98 ,, Hastings	1·88	3·48	2·06 ,, Lilydale
K	5·31	5·72	9·04 ,, Wilson's Py.	4·44	4·40	8·30 ,, Wood's Point
L	1·78	3·37	3·02 ,, Traralgon	2·75	2·62	3·55 ,, Traralgon
M	—	4·54	2·84 ,, Gabo	—	3·61	4·32 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F_1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F_2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I_1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

EXPORTS OF PERISHABLE AND FROZEN PRODUCTS FOR THE YEARS, 1902, 1901 and 1900.

Description of Produce.		1902.	1901	1900
Butter	lbs.	15,040,029	29,146,393	37,793,161
Cheese..	,,	797,438	325,627	827,025
Milk and Cream	,,	1,831,571	1,981,559	1,776,344
Poultry and Game	head	175,658	86,618	62,454
Eggs	doz.	67,428	40,428	82.068
Pork	lbs.	27,600	1,100	116,800
Mutton and Lamb	carcases	416,395	447,665	178,094
Beef	lbs.	629,260	440,300	315,200
Rabbits and Hares	pairs	3,274,210	2,092,727	2,839,112
Ham and Bacon	lbs.	3,387,411	2,801,097	2,205,474
Pork (salted)	,,	1,100	12,500	12,700
Meats (preserved)	,,	2,216,862	2,069,223	1,786,917
Rabbits (preserved)	,,	977,835	1,787,158	3,266,127
Fruits (fresh)	bushels	165,684	270,682	163,512
,, (bottled and canned) ..	doz. pts.	170,631	168,591	109,746
,, (dried)	lbs	1,036,243	201,609	195,255
Raisins	,,	1,291,669	824,806	663,177
Oranges aud Lemons	bushels	6,418	4,697	8,687
Fruit Pulp	lbs.	1,877,780	745,059	—

PRODUCE TREATED AND DELIVERED FROM THE GOVERNMENT COOL STORES DURING THE TWELVE MONTHS ENDING 30TH JUNE, 1903.

Description of Produce.		United Kingdom.	South Africa.	Eastern, Interstate and Other.	Total.	Approximate Value. C.I.F.
						£
Butter (Victoria) ..	tons	1,026	719	338	2,083	229,130
,, (Interstate) ..	,,	9	105	42	157	16,956
Milk and Cream ..	cases	1,035	1,616	7,883	10,534	13,167
Eggs	doz.	—	397	85,166	85,563	4,278
Fowls and Ducks ..	head	—	53,640	15,663	69,303	8,663
Turkeys and Geese ..	,,	—	3,230	2,563	5,793	1,931
Rabbits	pair	1,967,812	7,524	8,988	1,984,324	124,020
Hares	,,	4,592	808	136	5,536	1,107
Mutton and Lamb ..	carcases	88,652	76,442	16,800	181,894	127,325
Veal	,,	15	2,274	78	2,367	4,734
Pork	,,	—	—	117	117	234
Beef	pieces	—	—	720	720	1,440
Fruit	cases	12,012	1,807	560	14,379	7,189
Fruit Pulp	,,	378	—	—	378	283
Sundries	lbs.	8,252	2,300	50,082	60,634	758
						£541,215

EXPORTS OF VICTORIAN PERISHABLE AND ALLIED PRODUCTS, AND THEIR DESTINATION, FOR THE YEAR 1902.

Exported to.	Butter.	Cheese.	Milk and Cream.	Ham and Bacon.	Eggs.	Poultry.	Pork (Fresh)	Pork (Salted)	Mutton and Lamb.
	lbs	lbs.	lbs.	lbs.	doz.	head.	lbs.	lbs.	carcases.
New South Wales ..	1,789,549	285,866	164,035	363,038	3,070	16,114	..	100	..
Queensland	1,605,578	332,776	82,420	102,497	152	..	..	..	4,250
South Australia ..	1,621,950	54,195	266,672	34,007	83	..	..	..	28
West Australia ..	3,620,077	79,648	719,890	2,788,264	444	19,334	21,600	600	30,218
Tasmania	440,841	33,610	119,321	88,604	595	..	..	..	21
New Zealand	..	..	500	1,257	..	..	..	..	..
Fiji	12,522	..	209,048	..	..	..	..	..	..
United Kingdom ..	1,394,276	40	63,047	..	..	2,506	900	..	226,740
Cape Colony	1,282,004	..	9,797	..	40	29,036	1,600	..	56,850
Natal	2,537,911	..	95,453	786	510	105,126	700	..	79,275
China	29,134	1,200	..	..	32	..	..	..	..
India	17,430	4,682	..	670	..	..	..	400	..
Hong Kong	71,634	..	1,930	..	..	98	..	..	..
Ceylon	76,496	3,121	5,000	195	..	..	..	..	4,184
Guam	14,551	1,397	..	6,772	693	602	300	..	343
Japan	6,056	..	..	..	..	..	..	..	..
Java	242,174	..	..	..	..	..	..	..	..
Burmah	12,330	..	..	..	..	..	..	..	..
Phillipine Islands ..	128,454	..	92,258	1,103	..	2,828	..	..	2,475
Sandwich ,, ..	10,740	..	..	..	..	..	..	..	..
Straits Settlements ..	113,746	842	..	70	..	..	..	..	..
Beira..	5,170	..	..	..	..	..	..	..	282
Mauritius	3,396	..	..	..	..	..	..	..	..
Friendly Islands ..	700	..	..	..	..	..	..	..	..
Loyalty ,, ..	600	..	..	..	..	..	..	..	..
Malden ,, ..	150	61	..	148	..	..	..	..	..
Egypt	1,000	..	..	..	..	..	1,600	..	1,463
Malta	..	..	..	..	..	..	..	..	5,946
Siam	1,120	..	..	..	..	..	..	..	..
Banda Islands ..	440	..	..	..	..	..	..	..	..
France	..	..	1,800	..	..	..	..	..	..
Germany	..	..	..	..	..	..	..	..	..
Transvaal	..	..	..	..	..	..	..	..	4,179
Totals	15,040,029	797,438	1,831,571	3,387,411	5,619	175,644	26,700	1,100	416,254

EXPORTS OF VICTORIAN PERISHABLE AND ALLIED PRODUCTS, AND THEIR DESTINATION, FOR THE YEAR 1902—*continued.*

Exported to.	Beef.	Rabbits and Hares.	Preserved Rabbits.	Preserved Meats.	Fresh Fruit.	Oranges and Lemons	Raisins.	Dried Fruits.	Bottled and Canned Fruits.
	lbs.	pairs	lbs.	lbs.	bushels.	bushels.	lbs.	lbs.	doz pints
New South Wales ..	7,500	2,378	38,856	74,090	85,861	2,354	533,227	533,997	27,472
Queensland	..	172	66,919	282,985	15,756	185	289,203	365,598	22,342
South Australia ..	..	..	..	24,681	1,235	..	12,720	15,028	743
West Australia ..	252,300	58,284	6,088	274,785	3,259	326	43,336	22,465	90,915
Tasmania	..	..	912	133,289	20,618	2,718	144,177	22,427	8,144
New Zealand	..	..	..	544	3,255	790	228,102	39,448	548
Fiji	..	..	..	1,692	..	..	196	..	974
United Kingdom ..	4,700	3,196,302	772,440	636,212	30,018	2	50	11,791	1,077
Cape Colony	135,700	10,844	67,418	167,328	550	..	240	2,820	5,324
Natal..	141,500	3,940	19.058	586,558	793	..	39,560	17,580	2,841
China	..	..	..	..	50	..	..	..	60
India..	..	320	..	1,476	472	..	96	1,588	3,376
Ceylon	12,700	544	3,504	10,223	1,821	..	368	2,548	2,020
Guam	2,000	430	816	6,747	1,001	37	358	623	203
Japan	..	..	..	2,640	..	..	..	..	35
Java	..	..	..	..	..	..	..	330	1,453
Burmah	..	..	..	..	..	..	..	..	1,684
Phillipine Islands ..	17,900	996	..	..	..	..	..	..	..
Straits Settlements ..	..	..	1,632	5,612	469	..	36	..	625
Mauritius	..	..	..	1,152	20	..	..	..	..
Malden Islands ..	..	..	192	96	..	6	..	..	62
Egypt	2,000	..	..	4,866	..	..	..	..	..
Banda Islands.. ..	..	..	..	..	..	..	..	..	55
France	..	..	..	..	110	..	..	..	..
Germany	..	..	..	1,326	390	..	..	..	113
Transvaal	7,200	..	..	..	..	..	..	..	..
Canada	..	..	..	560	..	..	..	..	..
Madagascar	..	..	..	..	..	..	..	..	145
New Guinea	..	..	..	..	..	..	..	..	171
Cook's Island	..	..	..	..	..	..	..	..	20
New Caledonia ..	..	..	..	..	..	..	..	..	60
Corea	..	..	..	..	..	..	..	..	4
New Hebrides ..	..	..	..	..	..	..	..	..	15
Society Islands ..	..	..	..	..	..	..	..	..	20
Timor	..	..	..	..	..	..	..	..	5
Samoa	..	..	..	..	..	..	..	..	125
Totals	583,500	3,274,210	977,835	2,216,862	165,678	6,418	1,291,669	1,036,243	170,631

Farm Produce.

EXPORTS INSPECTED AND CERTIFIED TO during the year ending June 30, 1903.

	Potatoes. Tons.	Onions. Tons.	Hay. Tons.	Chaff and Compressed Fodder. Tons.	Wheat. Bags.	Oats. Bags.
South Africa	730	1,131	160	715	—	62,134
Manila and Islands ..	6	180	—	—	—	—
New Zealand	30	100	—	—	—	—
United Kingdom.. ..	3	—	—	—	—	—
Germany	5	—	—	—	—	—
New South Wales ..	1,880	2,916	—	450	—	1,431
Queensland	4,030	1,194	120	175	1,204	832
West Australia	1,906	247	—	—	810	339
South Australia	432	24	—	—	—	—
Totals	9,022	5,792	280	1,340	2,014	64,736

In addition, 25 bags of Barley, 200 bags of Haricot Beans, 10 bags of Rye, 5 bags of Lucerne Seed, and 9 bags of mixed seeds were sent to South Africa; 78 bags of Turnips and Carrots to New South Wales, and 96 bags of Maize to Queensland.

J. KNIGHT.

Fruit, Plants, Etc.

IMPORTS AND EXPORTS OF FRUIT, PLANTS, AND GRAIN INSPECTED for the Twelve Months ending June 30, 1903.

	IMPORTS.			EXPORTS.		
	Australasian.	Extra—Australasian	Total.	Australasian.	Extra—Australasian.	Total.
Apples .. cases	119,156	702	119,858	56,379	83,442	139,821
Apricots .. ,,	740	—	740	5,926	—	5,926
Bananas .. ,,	3,234	—	3,234	28,039	—	28,039
Black Currants ,,	1,737	—	1,737	—	—	—
Blackberries ,,	944	—	944	7	—	7
Cherries .. ,,	—	—	—	15,459	—	15,459
Custard Apples ,,	5	—	5	—	—	—
Citrons .. ,,	1	—	1	3	—	3
Cucumbers ,,	4,592	—	4,592	548	—	548
Figs .. ,,	—	—	—	730	—	730
Gooseberries ,,	69	—	69	3,339	—	3,339
Granadillas ,,	10	—	10	—	—	—
Grapes .. ,,	103	—	103	12,131	201	12,332
Jack Fruit .. ,,	1	—	1	—	—	—
Lemons .. ,,	16,317	14,501	30,818	14,228	20	14,248
Loquats .. ,,	1,789	—	1,789	20	—	20
Mangoes .. ,,	525	—	525	—	—	—
Melons .. ,,	44	—	44	166	—	166
Mixed Fruit ,,	3	8	11	382	—	382
Nectarines.. ,,	—	—	—	388	—	388
Oranges .. ,,	179,763	5,004	184,767	9,865	—	9,865
Passion Fruit ,,	9,152	—	9,152	855	—	855
Paw-paws .. ,,	1	—	1	—	—	—
Peaches .. ,,	1,065	—	1,065	7,390	—	7,390
Pears .. ,,	485	243	728	97,310	4,322	101,632
Persimmons ,,	158	—	158	21	—	21
Pineapples.. ,,	58,189	6	58,195	3,986	—	3,986
Plums .. ,,	20,491	—	20,491	20,021	—	20,021
Pomegranates ,,	—	—	—	1	—	1
Quinces .. ,,	—	—	—	9,171	8	9,179
Red Currants ,,	24	—	24	1	—	1
Shaddocks .. ,,	46	33	79	—	—	—
Strawberries ,,	18	—	18	2	—	2
Tomatoes .. ,,	3,949	—	3,949	3,384	—	3,384
Bananas .. bnchs.	767,481	—	767,481	—	—	—
Blackberries casks.	182	—	182	—	—	—
Black Currants pkgs.	1,361	—	1,361	—	—	—
Bulbs .. ,,	—	140	140	15	—	15
Plants .. ,,	995	199	1,194	2,399	—	2,399
Raspberries buckets	83	—	83	7	—	7
Barley .. bags	261	54,000	54,261	—	—	—
Gram .. ,,	—	250	250	—	—	—
Oats .. ,,	127,603	409	128,012	—	—	—
Peas .. ,,	683	—	683	—	—	—
Rice .. ,,	—	50,135	50,135	—	—	—
Wheat .. ,,	23,752	670,241	693,993	—		
Totals ..	1,345,012	795,871	2,140,883	292,173	87,993	380,166

FRUIT, GRAIN AND PLANTS INSPECTED FOR IMPORT AND EXPORT for year ending June 30th, 1903.

	Imports.			Exports.	
	Pkges. Passed.	Pkges. Condemned.	Certificates Issued.	Pkges. Passed.	Certificates Issued.
Fruit	1,212,215	26,644	5,320	377,752	23,739
Grain	927,334	5,250	55	—	—
Plants	1,194	—	1,072	2,399	1,292
Bulbs	140	—	128	15	14
Total.. ..	2,140,883	31,894	6,575	380,166	25,045

DESTINATION OF FRUIT EXPORTED beyond the Australian Commonwealth and New Zealand during season 1903, and compared with seasons 1901 and 1902:—

Destination.	Apples. cases.	Pears. cases.	Other Fruits. cases.	Totals. 1901.	Totals. 1902.	Totals. 1903.
United Kingdom ..	57,401	3,685	201 (Grapes)	27,361	36,797	61,287
South Africa	15,186	64	—	6,067	4,524	15,250
Germany	5,049	201	—	—	—	5,250
Java	3,037	337	20 (Lemons)	—	—	3,394
India	2,110	35	8 (Quinces)	2,502	1,657	2,153
Italy	25	—	—	—	—	25
Malay Peninsula ..	450	—	—	20	200	450
Belgium	182	—	—	—	—	182
China	2	—	—	100	50	2
U.S., America	—	—	—	—	100	—
Totals	83,442	4,322	229	36,050	43,328	87,993

J G. TURNER

*PRICES OF VICTORIAN APPLES IN LONDON.

Compiled by G. H. Robinson from priced catalogues issued by Messrs. Dennis and Sons, London, representing about 23,000 cases.

Variety.	Cases.	Average Price.		Highest Price.		
		s.	d.	s.	d.	
Fillbasket	11	13	9	16	6	in Arcadia
Cleopatra	1,651	12	3	20	0	,, ,,
Munro	634	11	5	18	0	,, ,,
Prince of Pippins	108	11	2	13	0	,, India
Jonathan..	6,131	10	9	20	0	,, Arcadia
Dumelow	187	10	9	17	6	,, Ormuz
Bismarck	141	10	9	14	0	,, Arcadia
Winesap	16	10	8	11	6	,, Ormuz
Annie Elizabeth	194	10	4	12	6	,, ,,
King of Pippins	43	10	0	11	0	,, India
Adam's Pearmain	26	10	0	11	6	,, Orizaba
Alfriston	69	9	9	9	9	,, Orestes
Shepherd's Perfection ..	60	9	9	12	6	,, Ormuz
Rome Beauty	3,127	9	8	14	0	,, Arcadia
Ribston	251	9	8	20	0	,, Omrah
Sturmer	712	9	7	12	0	,, India
Newtown	50	9	6	13	0	,, Orizaba
Esopus	106	9	6	13	0	,, Omrah
Statesman	263	9	5	10	6	,, Orizaba
Stone Pippin	235	9	5	12	0	,, Omrah
Five Crown	5,957	9	4	15	0	,, Arcadia
Rymer	881	9	2	12	6	,, Omrah
Cox's Orange Pippin ..	250	9	2	19	0	,, India
Hoover	116	9	0	11	0	,, Ormuz
Nickajack	43	9	0	9	9	,, Orizaba
Scarlet Nonpareil	38	9	0	9	9	,, Australia
Majetin	20	9	0	9	0	,, ,,
Ben Davis	235	8	11	10	6	,, India
Margil	44	8	8	11	6	,, Omrah
Reinette de Canada	1,079	8	1	9	9	,, India
Buncombe	137	7	10	8	6	,, Australia

* Exclusive of Wet, Frozen or Ullaged Cases.

COMPARATIVE PRICES IN 1901, 1902, AND 1903.

	* 1901.			† 1902.			1903.		
	Cases.	Average.		Cases.	Average.		Cases.	Average.	
		s.	d.		s.	d.		s.	d.
Cleopatra	2,048	13	10	1,573	11	11	1,651	12	3
Munro	1,162	12	2	1,074	11	7	634	11	5
Jonathan	1,578	12	8	1,850	12	4	6,131	10	9
Dumelow	—	—		100	14	10	187	10	9
Bismarck	71	9	4	—	—		141	10	9
Annie Elizabeth	60	13	4	—	—		194	10	4
Rome Beauty	460	10	6	947	10	7	3,127	9	8
Ribston Pippin	38	8	4	—	—		251	9	8
Newtown	71	11	5	110	14	3	50	9	6
Stone Pippin	49	9	5	200	9	5	235	9	5
Five Crown	2,321	10	6	1,286	9	11	5,957	9	4
Rymer	—	—		846	9	2	881	9	2
Ben Davis	56	10	9	—	—		235	8	11
Reinette de Canada ..	116	8	4	225	8	5	1,079	8	1

* Mr. Vear's list. † Mr Lang's list.

Frozen Meat, &c.

PRODUCE INSPECTED AND EXPORTED DURING THE YEARS ENDING 30th JUNE, 1902 and 1903 RESPECTIVELY.

Kind of Produce.		1901-2.	1902-3.
Carcases of Lamb		227,182	106,199
,, ,, Mutton		03,304	219,451
,, ,, Beef		616¼	1,143
,, ,, Veal		1,870	6,834
,, ,, Pork		1,429	820½
Pieces of Pork		—	29
,, ,, Beef		414	1,669
,, ,, Mutton		1,930	813
,, ,, Kid		8	—
No. of Legs of Mutton		15,589	7,114
Cases of Mutton Hams		—	22
Calves' Feet	pkgs.	7	1,050 feet and 25 pkgs.
,, Heads	,,	63	280 heads and 74 ,,
Ox Tongues	,,	19	531 tongues and 30 ,,
,, Tails	,,	—	236 tails and 27 ,,
Sheep's Kidneys	,,	566	2,647 kidneys
,, Tongues	,,	285	3,240 tongues, 1 tierce and 97 pkgs.
Cases of Ox Kidneys		7	59
,, ,, Sheep's Trotters		139	56
,, ,, Pig's Feet		3	—
No. of Sheep's Frys		—	6,622
,, ,, Sweetbreads..		34	616
Brains		—	650 sets and 6 pkgs.
Sausages	pkgs.	25	388 lbs. and 78 ,,
Cases of Meat Extract		—	23
,, ,, Mutton Suet		—	10
,, ,, Sausage Casing		34	—
Dripping	lbs.	5,740	234,794
Bacon and Ham	,,	1,100	16 sides
Casks of Margarine..		—	1
Kegs of Corned Beef		88	183
,, ,, ,, Pork		—	3
Cases of Beef and Mutton Sundries ..		366	295
,, ,, Fish		303	79
No. of Frozen Rabbits		3,106,650	8,087,538
,, ,, ,, Hares		192	2,977
Cases of Frozen Poultry		124,110	116,157
Canned Rabbit	lbs.	671,024	1,195,008
,, Meats	,,	3,264,478	3,365,424
Cases of Canned Hares		226	1
,, ,, ,, Poultry		1,093	184
,, ,, ,, Fruit		157	50
,, ,, ,, Vegetables		10	36
,, Tomato Sauce		—	15
Jam	lbs.	915,888	23,040

A. A. BROWN.

AMENDED REGULATIONS CONCERNING SWINE FEVER.

1. The Orders in Council dated 13th July, 1903, and 6th August, 1903, are hereby rescinded.

PRELIMINARY.

2. APPLICATION OF ORDER.—These regulations are divided into two parts. The first part shall be applicable to the whole of Victoria, and the second part shall apply only to an area declared by His Excellency the Governor in Council by Order in Council to be a swine fever infected area, which area is in this Order referred to as an "Infected Area."

PART I.

3. ON DISEASE BREAKING OUT OWNER OF SWINE TO NOTIFY THAT FACT TO CHIEF INSPECTOR, ETC.—In case of swine fever or any other disease whatever breaking out, or deaths occurring amongst swine in any part of Victoria, the owner of the swine affected, or, in his absence, the person for the time being in charge of the swine shall forthwith, in writing, notify the Chief Inspector of such outbreak, and shall forthwith isolate any animal or animals that has or have developed the disease from those not affected by removing the latter to a distant part of the premises, so as to avoid the spread of the disease, and shall at once destroy by fire any litter with which the infected animals have come in contact, and cleanse and disinfect all places in which any swine on the premises have been kept or had access to. All carcases of swine which may have died shall be retained intact, until otherwise authorized by an Inspector of Stock.

4. NO SWINE TO BE REMOVED FROM PLACE WHERE DISEASE DEVELOPS.—No swine shall be removed from any place where disease exists or has existed, or at which any deaths have occurred within 60 days, without the authority of an inspector of stock.

5. INSPECTOR'S AUTHORITY TO PERMIT REMOVAL LIMITED.—No inspector shall in any case give his authority for the removal of any infected swine from off the premises where swine fever has developed, nor in the case of other swine on such premises, except to some other portion of the same holding, until and unless such other swine have been disinfected under the supervision or to the satisfaction of the inspector, and a period of 60 days has elapsed from the isolation of such other swine from any infected swine, and from the sty or other place in which any infected swine have been kept or had access to.

6. HOW AREAS MAY BE DECLARED "CLEAN."—No area shall be deemed to be a "clean" area unless

(1) All pigs and piggeries in such area have been systematically inspected by an inspector of stock or duly authorized

veterinary surgeon, and declared by him to be free from disease, and

(2) Unless every pig owner or his agent signs a declaration to the effect that no disease has existed on his premises for a period of not less than 3 months immediately preceding the date of inspection. If any owner or agent refuses to sign such declaration the premises of such owner shall be forthwith quarantined.

7. Sale of Store Pigs in a "Clean" Area.—No sale of store pigs can be held at a public sale yards in a "clean" area, unless such pigs are sold in a vehicle from which they may be removed to another vehicle without being put in pens.

8. Interpretation.—In this Order, "Order" shall mean Order in Council; "inspector" shall mean inspector of stock, "licence" or "authority" shall mean the licence to move swine granted by inspector of stock or authorized veterinary surgeon to allow of swine being moved within an area declared for the time being to be a swine fever infected area; "authorized veterinary surgeon" shall mean a veterinary surgeon under the *Veterinary Surgeons Act 1890*, authorized in writing, by the Minister, either generally or in any particular case to exercise the particular authority conferred on an authorized veterinary surgeon by these regulations; "Minister" shall mean the Minister for the time being administering the *Stock Diseases Act 1890*; "infected area" shall mean any lands or premises which the Governor in Council may from time to time proclaim a quarantine district for pigs.

9. Slaughtering of Pigs in "Clean" Area.—Pigs may be slaughtered in any "clean" area, either for market or home use, provided that the owner or his agent gives at least 48 hours' notice in writing to the nearest inspector of stock, such notice to set forth the date on which such slaughter is to take place, the number of pigs to be slaughtered, and the intention regarding the disposal of the carcases.

Part II.

10. Restriction on Movement of Swine from an Infected Area into a "Clean" Area.—Swine shall not be moved along, over, or across a highway or thoroughfare in an infected area, whether in a vehicle or not, except as expressly authorized by this Order.

11. How Swine may be Removed from Premises.—The owner of any swine within an infected area shall not remove or permit their removal from the premises on which they are kept without the permission, in writing, in the form or to the effect of the form in Schedule A hereto, of an inspector of stock or of an authorized veterinary surgeon authorized by the Minister of Agriculture to give permission under these regulations, and no inspector of stock or authorised veterinary surgeon shall grant such permit unless and until he shall have personally inspected such swine, or unless and until he shall have received from the owner thereof a declaration in the form of Schedule C, accompanied by a certificate from a duly authorized veterinary surgeon in the form or to the effect of the form in Schedule D hereto, and further in the case of

any authority granted under this regulation by an authorized veterinary surgeon, it shall be necessary at the time of issuing same that a certificate of health, as per Schedule D shall together with the declaration as per Schedule C, be forwarded to the Chief Inspector of Stock, Melbourne.

12. Fat Pigs for Sale or Slaughter to be Branded.—All fat pigs to be sold in public markets or intended for slaughter must be branded with a fire brand at the time of granting of a movement license in regard thereto, and such brand must be recorded on the license by the person granting the same.

13. How Swine to be Removed from Premises are to be Conveyed.—Swine duly authorized to be removed from such premises shall not be travelled on foot, unless authorized in special cases by the Chief Inspector of Stock, but shall be taken by an approved conveyance which, after being so used, shall be thoroughly cleansed and disinfected by the owner or person in charge under the supervision of or to the satisfaction of the inspector. Swine so removed may be taken to the place of sale, if the authority is granted for that purpose, and thence to the abattoirs or bacon factory where they are to be slaughtered, and which shall be an abattoir or bacon factory approved by the Chief Inspector of Stock, or if intended for slaughtering without being first put to sale to an abattoir or bacon factory, approved by the Chief Inspector of Stock, and in either case shall be there slaughtered under the supervision of an officer approved by the Chief Inspector of Stock within six days after such removal.

14. Notwithstanding anything contained in these regulations, pigs not intended for slaughter may be removed from premises on which located direct to other premises, from which they shall not again be removed until at least 28 days shall have elapsed, but no such removal or removals as herein mentioned shall take place unless and until all the requirements referred to elsewhere in these regulations regarding authority for removal shall have been complied with.

15. Destruction of Diseased Swine and Disinfection of Premises.—All diseased swine, or swine showing symptoms of disease, shall be killed upon the premises on which they are kept, and completely consumed by fire, and such premises shall be thoroughly disinfected by the owner under the supervision or to the satisfaction of the inspector of stock. Swine not infected, but which have been in contact with infected swine, may be slaughtered by authority and under supervision of an inspector or authorized veterinary surgeon and the carcases thereof sold, but, in such cases, the offal of the slaughtered swine shall be destroyed by fire.

16. Attendants on Diseased Swine to Disinfect Clothes, &c. —Any attendant on diseased swine shall before leaving the premises change his or her clothes and boots, and thoroughly disinfect them to the satisfaction of the inspector.

17. Inspector May Require Persons Coming into Contact with Swine to Disinfect Apparel.—In any case where an inspector of stock considers it necessary he may require every person who has come into contact with any swine, the condition of which swine as regards freedom from infection from swine fever such inspector is doubtful of, to forthwith take all such means as such inspector may

consider necessary to disinfect themselves and their wearing apparel, so as to prevent the spread of disease should such swine develop the same.

18. Inspector May Require Places Where Swine Have Been to be Disinfected.—Every inspector may from time to time require every place where any swine are, or have been kept, or to which they may have or have had access, as well as all vehicles in which swine have been conveyed, or articles with which they have come in contact, to be thoroughly cleansed and disinfected under the supervision or to the satisfaction of the inspector.

19. Owners of Swine to Register Their Premises.—Every person keeping, or intending to keep, swine upon his premises shall notify, in writing, the Chief Inspector of Stock or the nearest inspector of stock of such fact, such notice to state the numbers, sexes and description. When at the publication of this regulation any swine is kept, such notice as aforesaid shall be given within three weeks after the date of such publication. When at any time thereafter it is proposed to keep any swine on any premises, such notice shall be given before any swine are kept. Every person keeping swine on the 1st day of January in any year shall within fourteen days of that date in each year notify that fact to the Chief Inspector by a notice in writing, any previous notice notwithstanding.

20. Swine May Be Slaughtered.—Swine may be slaughtered on the premises on which they have been kept during 28 days provided that the owner or his agent gives at least 96 hours' notice in writing to the nearest inspector of stock, such notice to set forth the date on which such slaughter is to take place, the number of swine to be slaughtered, and the intention regarding the disposal of the carcases thereof.

He must also sign a declaration in the form of Schedule C., from which the following words may be deleted :

> "And that during such period there have not been brought any pigs on to the premises in which these were kept, nor have they" and the following words substituted therefor "and have not."

This declaration must be signed and must accompany the carcases to their destination.

21. Swine from an Infected Area Travelling through "Clean" Area.—Swine from an infected area shall not be permitted to enter a "clean" district unless for the purpose of travelling through such "clean" district by rail or for the purpose of being slaughtered within such "clean" district. In the latter case, however, it will be necessary for the swine to travel from the infected area by railway trucks, from which they shall be unloaded into and conveyed by vehicles, under the supervision of an Inspector of Stock, to an abattoir approved by the Chief Inspector of Stock, where they shall be slaughtered under the supervision of an officer approved by the Chief Inspector of Stock within six days after their arrival thereat.

22. Movement of Swine from a "Clean" Area.—Swine coming from a "clean" area may be moved without inspection provided that they are accompanied by a declaration in the form of Schedule B., signed

before a Justice of the Peace or other authorized person, to the effect that the pigs are the *bona fide* property of the person making such declaration or on whose behalf it is made, that they have been in his possession for at least 28 days and that during such time they have not been outside a "clean" area, that they are not affected with swine fever and have not in any way been exposed to the infection of swine fever and that the movement of such swine is not prohibited, and further provided that they are conveyed in an approved conveyance as provided for in Clause 13 of these regulations.

23. Fact of Swine Dying to be Notified.—In the event of any swine in an infected area dying, the owner or person in charge thereof shall within 24 hours send notice of such death or deaths to the Chief Inspector of Stock, Melbourne, or the nearest inspector of stock.

24. Regulation of Sale in Infected Area.—No market, fair, sale, or exhibition of swine, shall be held in an infected area except a sale authorized by the Chief Inspector of Stock or a sale held in accordance with the following conditions :—

(1) All the swine exposed at the sale must have been on the premises of the vendor for a period of at least 28 days immediately before the date of sale ; and no swine must have been brought on to those premises within such period, whether for breeding purposes or otherwise.

(2) The swine must not be affected with swine fever or have been exposed to the infection of swine fever during the said period ; and

(3) The sale must not be held in a swine fever infected place, and the movement of the swine must not have been prohibited by notice of an inspector of stock.

25. Straying of Swine on Highways.—No swine shall be allowed to stray on a highway or thoroughfare or on the sides thereof in an infected area.

26. Production of Licences. Names and Addresses.—

(1) Any person in charge of swine which are being moved, when under this Order a movement licence is necessary, shall on demand of a Justice of the Peace, or a member of the police force, or of an inspector or railway official, produce and show to him the authority for such movement, and shall allow it to be read, and a copy of or extract taken by the person to whom it is produced.

2) Any person so in charge shall on demand, as aforesaid, give his name and address to the Justice, or member of the police force, or inspector, or railway official.

Schedule A.

Movement Licence.

Swine Fever. Disease in *Stock Act 1890.*

Movement Licence. Swine fever. Movement Licence for Swine.

No.

Licence No. I, the undersigned, being authorized by the Department of Agriculture of the State of Victoria, do hereby licence such movement of the undermentioned swine along, over, or across any highway or thoroughfare in a swine fever-infected area as is necessary for the purpose of their movement to the undermentioned premises.

Licence granted on declaration of
for movement of swine from
to
Name and address of Licensee.
Number of Swine.
Description.

Name and Address of Person to whom this Licence is Granted.	Number and Description of Swine to be moved	Where from.	Where to.

This licence is available for three days, including the day of the date hereof and no longer.

Signed. Signed—

Inspector of Stock or
Authorized Veterinary Surgeon.

Dated. Dated—

This permit must be returned to the Inspector of Stock after the swine have been moved, or the Chief Inspector of Stock, Melbourne.

Schedule B.

Declaration for use in case of movement of swine into a swine fever-infected area. Stock Diseases Act 1890.

Declaration of owner (or his agent)—

I, , of , in the parish of , county , do hereby sincerely and solemnly declare

(*a*) That I am the owner (or agent for the owner) of the undermentioned swine, which have been in my (or his) possession for twenty-eight days;

(*b*) That the place of destination is

(*c*) That they are free from disease, and now at from whence they are to be moved to the premises of at , which are within an infected area;

(*d*) That the swine are not at the date hereof in a place infected with swine fever;

(*e*) That to the best of my knowledge and belief the swine are not affected with swine fever, and have not been in any way exposed to the infection of swine fever; and

(*f*) That the movement of the swine is not prohibited.

Number and Description of Swine to be moved.	Name or Description of Place and Premises from which Swine are to be moved, and District in which situated.	Place of Destination, stating Name or Description of Place and Premises to which Swine are to be moved, and authority for such movement.

And I make this declaration conscientiously believing the same to be true, and by virtue of the provisions of an Act of Parliament of Victoria rendering persons making a false declaration punishable for wilful and corrupt perjury.

Declared before me, at in the State aforesaid, this day of in the year of our Lord One thousand nine hundred and

Justice of the Peace, or
Commissioner for taking Declarations and Affidavits.

Schedule C.

Declaration of Owner of Pigs.

I

of

do solemnly and sincerely declare that the undermentioned swine have been on my premises for the past twenty-eight days, and that during such period there have not been brought any pigs on to the premises in which these were kept, nor have they to the best of my knowledge and belief been exposed to the infection of swine fever, and are free from all infectious and contagious diseases.

Particulars of numbers and sexes.

And I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of an Act of Parliament of Victoria rendering persons making a false declaration punishable for wilful and corrupt perjury.

Declared at in the State of Victoria

day of One thousand nine hundred and

Before me

Justice of the Peace

or

A Commissioner of the Supreme Court of the State of Victoria for taking Affidavits, or Commissioner for taking Declarations and Affidavits.

I have no reason to doubt the correctness of this Declaration in any particular.

Inspector of Stock
or Veterinary Surgeon.

Schedule D.

Certificate by Veterinary Surgeon.

I, , of

being a duly qualified and recognised veterinary surgeon under the Veterinary Surgeons Act, Victoria, No. 1154, do hereby certify that I have this day examined pigs on the farm (or premises) of at and find them free from swine fever and other contagious and infectious disease.

Number.	Particulars.

Veterinary Surgeon.

Dated 190 .

And the Honorable John William Taverner, His Majesty's Minister of Agriculture for the State of Victoria, shall give the necessary directions herein accordingly.

THOS. BRISBANE,
Clerk of the Executive Council.

PUBLICATIONS ISSUED BY THE DEPARTMENT.

Bulletins.

Reprinted from the Journal.

No. 1. Impressions of Victoria from an Agricultural Point of View. By S. Williamson Wallace.
No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
No. 4. Review of the Past Butter Season. By R. Crowe.
No. 5. Two Years' Field Work of the Chemical Branch. By F. J. Howell, Ph. D.
No. 6. Co-operative Forage Experiments in Southern Victoria. By F. J. Howell, Ph. D.

Guides to Growers.

No. 19. Lavender. By J. Knight.
No. 20. Broom Corn. By J. Knight.
No. 24. The Fig Industry. By C. B. Luffmann.
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No. 26. Treatment of the Raisin Vine. By C. B. Luffmann.
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The New Agriculture. By the Hon. I. A. Isaacs.

Report on the Export of Frozen Produce from Victoria,				1896-7.	D. Wilson
Do.	do.	do.	do.	1897-8.	do.
Do.	do.	do.	do.	1898-9.	do.

The Beet Sugar Industry in Victoria. By A. N. Pearson.
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Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
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Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
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Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
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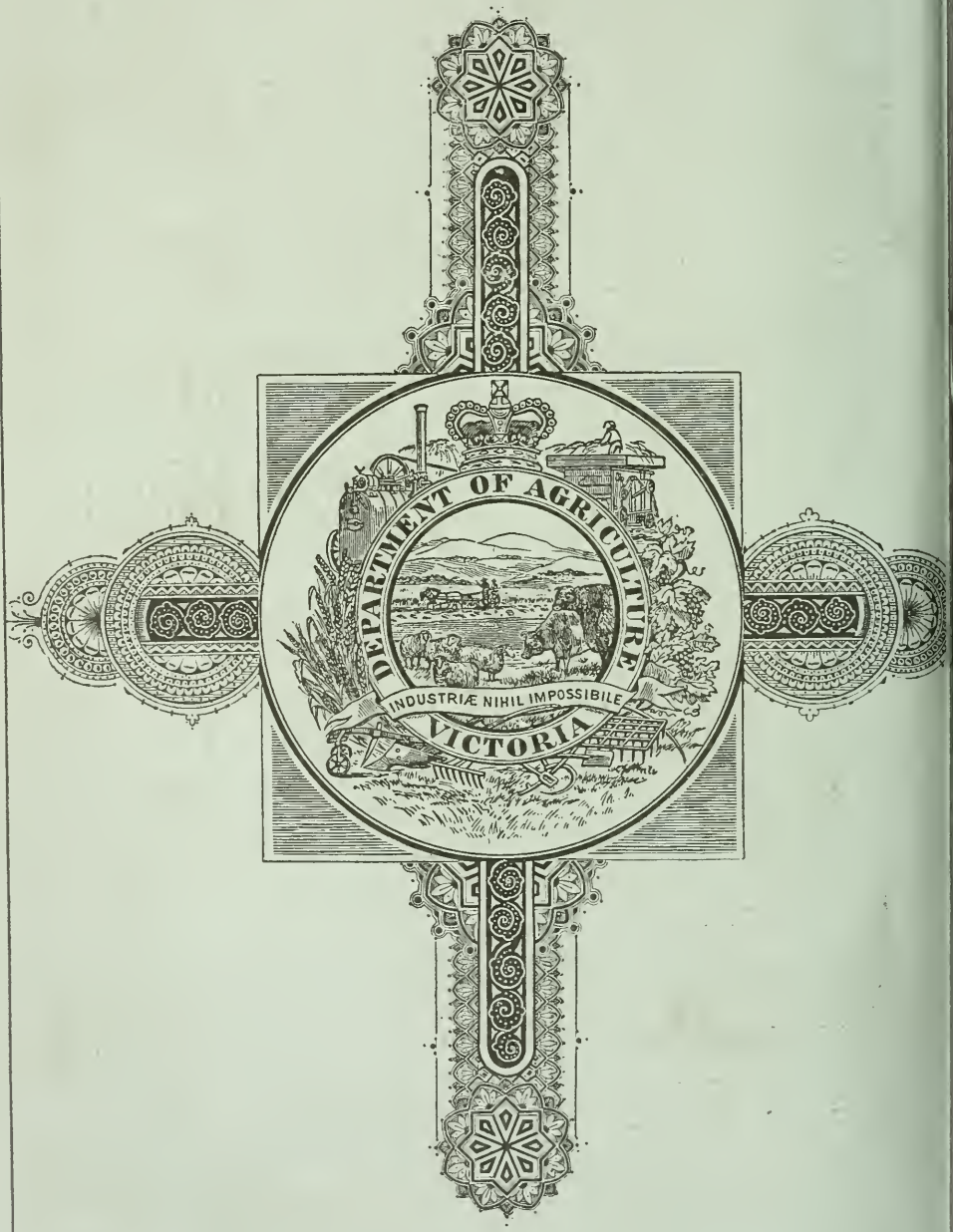
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THE NEED FOR SOIL INVESTIGATIONS.

By S. Williamson Wallace, Director of Agriculture.

The functions of an Agricultural Department are not only educational and inspectional—they are, or should be, in the highest degree investigational also. It is, in fact, upon the support we shall give to research work, and the vigour with which it is carried out, that all advances in our agricultural practice will depend. In a new country such as this, with little or nothing of the accumulated experience belonging to centres with an old established agriculture, there is naturally a very great deal still to do in the dissemination of some of the facts from the great mass of knowledge acquired by investigators elsewhere. A few years of vigorous lecture work is sufficient, however, to exhaust this source, and without an equally vigorous concurrent system of research the educational agencies of the future must be confined in their activity to a mere repetition of stale facts. It is doubtless true that, were never a moment's time given to research work in Victoria, we should still benefit to an extent from investigations carried out elsewhere, but it must be apparent to the most casual observer that we have our numberless local problems which can only be solved by local effort.

If we look into our own Department of Agriculture, it appears to me that the investigational side of its activities has suffered a good deal of neglect—not, very probably, an intentional neglect, but one that followed as a natural course from a tendency, common in new countries looking to bone and muscle as the main factors to success, to regard as worthless all investigation which does not end in an immediate possible practical application. If there is one fact which points more strongly than another in the direction referred to, it is, I think, the absence of a properly equipped Experiment Station in Victoria. One of my earliest suggestions, it will be remembered, was the establishment of such a station.

With the establishment of such a station, which is now a recognised necessary institution in all parts of the world, our Department could enter upon a systematic and truly scientific set of investigations which would, I feel sure, exercise a profound influence upon our agricultural practice.

In the absence of such a station, it must be recognised that great work has been done through other agencies, and the solution of the fertilization requirements of our Northern soils by the Chemical Branch is an achievement of which the Department feels justly proud. Soil investigations of a similar character in the South have already resulted in facts of great value, and with a few years of vigorous field work, and the co-operative support of the farmer—for success, under present conditions, depends primarily upon this—we shall probably have a mass of very valuable information to impart. It is

the pronounced success of this class of work which for the moment has served as an argument against the necessity for the establishment of a permanent Station; but the officers engaged in this class of work recognise its limitations, and are alive to the advantages which this class of work even would derive from preliminary investigation of a similar character carried out at a permanent Station. In seeking to determine the soil requirements of different parts of the country, it is, of course, essential that investigations should be carried out in each locality; but such investigations form a part only of the great province of inquiry in the field. A greater support even of this class of investigations, admitting of their being carried out more on lines of pure research than as an immediate aid to farm practice, would result in facts of more general applicability.

The most important work in the scientific study of soils is their classification into types, and the determination of the characteristics of each type by the growing crop and by chemical and mechanical analysis. Under present conditions we are bound to take what the farmer offers us for experimental purposes. There may be half-a-dozen different types of soil in the district, and an opportunity offered for testing one only, due to the disinclination of farmers generally to co-operate with the Department.

We are assuming, now, that the principal application in Victoria of field investigations will for the present lie in the information to be obtained as to the use of manures; or, in other words, as to soil deficiencies. Now, by the co-ordination of the results of field experiments carried out on each type of soil with those of a soil survey of the districts, including naturally the chemical and mechanical analysis of each type, a splendid lot of information would be obtainable, rendering possible advice as to each type of soil—advice which might be applicable to large areas of similar character elsewhere.

It is on such lines as these that the Chemist of the Department is anxious to conduct his soil investigations; but to do this effectively there are additions to the staff required—especially in the field. One of the most pressing appointments necessary is an assistant to the Agricultural Chemist, competent to carry out the duties of Agricultural Geologist in connection with the experimental fields to be established, and the survey that might be made of the soils of each centre. Such an officer would first make a rapid survey of each district, determine the number of soil types, and arrange for manure tests on the soils of each type. A chemical and mechanical analysis would reveal the distinguishing features of each type. From the record of crops found to succeed on such types, comparisons could be made of the texture of each soil, and the climatic conditions of the district with conditions prevailing in other parts, and advice as to the likelihood of similar plants thriving or failing there could be freely given. We have no data at present to pronounce such opinions, and it is the greatest mistake possible to suppose that a mere chemical analysis of a soil sent in from some unknown part will enable us to do so. Work taken up on these lines would proceed

gradually, and would be centred at first principally in districts showing the maximum of agricultural development. From the data derived from investigations in such districts there would be drawn a mass of information applicable to untried areas. It is for the Government and the country to support this class of work, and to recognise the knowledge that springs from it as fundamental to all progress in agriculture.

FIELD EXPERIMENTS OF THE PAST YEAR BY THE CHEMICAL BRANCH.

(A Paper Read before the Colac Conference.)

By F. J. Howell, Ph. D.

In my paper delivered at the Conference at Shepparton a twelvemonth ago I dealt exhaustively with the experimental field work of the Chemical Branch from its first inauguration under Mr. Pearson, up to the close of the season of 1901-2. In my paper special attention was given to the work in the field of the last two years. It embraced the period of my association and activity with the Department, and covered the time of those great developments in a line of educational work which, on account of its practical nature, has everywhere received the hearty support of the farmer. That conference was the last opportunity I had of meeting the farmers in a body, face to face, and speaking to them from the platform. To-day the opportunity again presents itself, and the opportunity, I need not tell you, brings with it unbounded pleasure. The matter of my present paper will constitute in a sense a continuation of the matter of my address of a twelvemonth ago. It will deal with the attempts and the success of the co-operative experimental field work from the time I addressed you last to the present moment. The ground to be covered in the exposition of these results is very extensive: in fact, so much, so that my paper can provide little more than a mere outline. The details must be filled in, in separate reports and papers which will come later. Those of you who were present at the Conference last year will remember how I summarized the results which had followed the two years of vigorous experimental field work in fertilization in the North. Before the presentation of new facts, we will start with clear ideas again of what the old facts were. Lectures on manuring have been so frequent, and publications on the same subject so general during the last three years, that all of you must have pretty clear ideas on the principles of fertilization. You will probably know the substances a plant takes up from the soil during growth, the substances which a soil is apt to become deficient in, and the particular manure we give to supply each substance. It is so important you should be fully informed on all these points that, at the risk even of wearying some of you, I will repeat again what I told you on that occasion. I told you then that a plant took up a large number of substances from the soil during growth, and that all, or nearly all, seemed essential to the health and normal development of the plant, but that we did not require to consider all of these in manuring, as the majority of them were present in the soil in practically inexhaustible quantities; quantities so large that continuous cropping without manures would probably not reduce them to a point affecting the productive power of the soil. I told you that there were three or

four substances, however, which in the average soil were liable to become exhausted. These four substances are nitrogen, phosphoric acid, potash and lime. All manuring has for its main object the giving back to the soil of either one, two, three or four of these ingredients. In giving farm-yard manure we give all of these substances back. But if a soil were only deficient in one of these ingredients it would be folly to give a manure containing them all. In other words, it would be carrying coal to Newcastle. To avoid this then, we have manures containing only one of the ingredients, and the list here will show you what these manures are :—

PHOSPHORIC ACID is contained in Superphosphate, Thomas Phosphate (Star Phosphate), Bonedust, Guano.

NITROGEN is contained in Sulphate of Ammonia, Nitrate of Soda, Dried Blood.

POTASH is contained in Potash Chloride, Potash Sulphate, Kainit, Ashes.

LIME is contained in Lime and Gypsum.

You will now know then what manures to apply if your soil is deficient in a particular ingredient or ingredients. Should your soil be deficient in three or four, then one from each group would require to be taken. But what the farmer really first wants to know is, what his soil is deficient in. And it is just here where the Department of Agriculture steps in. It has already taken the step with its experimental fields in the North, and its work has been the solution of this problem for the whole of the northern wheat area. The lands of the Mallee, the black soils of the Wimmera, and the red plains of the North have all been asked the question, and have all given the same reply :—"Nitrogen we have in abundance, potash in plenty, magnesia, soda, iron, chlorine, and the long list of all you say is essential to the healthy growth of the crops we raise; all these are with us in quantities above requirements. The one essential, failing us all, is phosphoric acid. Give us a mere sprinkling of this substance, and we promise you again crops equal to those which followed the first breaking with the plough." It was these facts then, facts referring to the results of soil investigations in the North which formed the bulk of the material contained in the paper I gave you a twelvemonth ago at Shepparton. It is at this point we can pick up the thread and treat of the work which followed.

The main problems of northern soils had then been solved, that is, the more immediate problems. For I do not wish it to be understood that there is nothing more to do in the investigation of soil problems in the North. There is a very great deal to do. What I mean is that the principal question of supreme importance for the present to the farmer had received the consideration that it for the moment required. The duty, however, of a Department of Agriculture is not only to investigate immediate, but to anticipate future requirements. Enough, however, for the present had been done in the

North to justify the principal attention being given to the soils of the South, and it is to this part of Victoria that our field investigations of last year were mainly directed. Those investigations were not confined to questions of fertilization only, but included considerations of a much wider range, affecting the destinies of important industries.

FERTILIZATION EXPERIMENTS.

In my paper of last year I called attention to the few fertilization experiments which up to that time had been undertaken in the South, and from the few results I then had to hand, I ventured to generalize on probable soil requirements, and the more complicated problems which it seemed likely the lands of that part of Victoria would offer the Chemist. The results of the past year have in every way confirmed the opinions I then expressed. The views offered in my former paper may be worth repeating. I there stated: "To generalize, then, on the soil requirements of the Southern districts is not the easy matter that it is with the northern areas. The smaller number of results to hand, and the various other reasons I have already called attention to, prevent one speaking with too much confidence, but a few striking facts stand out in the results before you; that is, that all these soils respond to phosphoric acid, and that a combination of a complete manure gives better results than phosphoric acid alone, that nitrogen is required in a much less degree generally than phosphoric acid, and potash to a still less extent. There will be soils where the various requirements might be in reverse order, but the facts I stated might, I think, be accepted as generally true." The work that was carried out last year was largely in the direction of further elucidating those questions. I will call your attention directly to the results of a number of crops grown upon experimental fields in different parts of Gippsland and the Western district. Two facts, however, I wish you to have clearly before you from the start. The first is the more complicated nature of soil investigations in the South, and the second, the far larger quantities of manures we shall require to use there than in the North. I have already incidentally referred to the first difficulty. This greater complexity in the solution of fertilization problems in the South depends upon a number of circumstances. The greater diversities of soil and differences in rainfall, and the wide range of crops possible, each with its special requirements, are among the causes mainly contributing to this. In the North, it was essentially one crop, with a rainfall of no wide variation, and soils in their chemical composition at any rate of a very marked uniformity of character. The solution of fertilization problems there was an easy one. And now, then, a few words on the second fact which I wish you to hold before you, the necessity of far heavier manurial dressings in the South than in the North. There are compensating conditions for all positions in life. The poor farmer of the North has found his in the remarkably small yearly outlay required for the

fertilization of his worn out soils. You of the more favoured South will not envy him the one little good fortune he has struck. It is now a recognised fact that soils of arid areas are, as a rule, fertile soils. You will know the constant chemical changes going on in our soils, and how the insoluble matter that the plant roots are unable to make use of is gradually being changed into soluble forms that can serve as plant food. Year after year the accumulation of these soluble salts is taking place in the dry northern areas, for the rains are not sufficiently heavy to wash them out. In humid climates, however, the leaching action of heavy rains is responsible for the loss of large quantities of these soluble forms of plant food. It is reasonable, then, to think that quantities of manure, proving sufficient in dry areas, should be quite inadequate under humid conditions. You have also to consider the very much larger crops obtained in the South than in the North, and you have to remember, as I think I shall show you, that it is not a question of replacing one deficiency in the soil, but in cases two, three and four. Now, under such conditions, it is no use talking of pounds of manure to the acre as we do in the North. It is a question, I fear, of hundredweights, and not pounds. It will take the southern farmer some little time to grip this fact, perhaps, and the gospel of manuring will not receive the immediate popularity it did in the North. But it will finally become popular there also, for the question, after all, is not the cost of manuring, but the profits above and beyond that cost. The cost will undoubtedly be heavier, but the increased returns will be also correspondingly larger. And if by manuring we can convert those large areas in the South, which may be classed as of second quality, into lands approaching, or perhaps equalling in productive power, the first-class soils; and if those extensive stretches regarded as third class may be also transformed into profitable holdings, then manuring, in spite of its larger cost, will be credited with a transformation in the Agriculture of the South as far-reaching and important as the changes which have followed its introduction in the North. These introductory remarks, I fear, have been a little long, but were necessary to pave the way for a clear understanding of what is to follow.

Hay Crops in Southern and Western Districts.

The returns given in table A, page 302, represent the average of 30 fields. Before inquiring into what manures have been used, and what manures have acted, a glance as to how these manures have operated will reveal some very significant results. We find these results in the figures of the general average. You will see that plots 2, 5, 8, 11 and 14 are unmanured plots. And you will notice that the yields of the unmanured plots are almost identical. In plot 2 it is 1·67 tons; plot 5, 1·58; plot 8, 1·67; plot 11, 1·69; and plot 14, 1·69 tons. Taking the average of these 150 plots, we get 1·66 tons as the average yield of the unmanured ground of the 30 fields. On plot 15, however, the manured plot showing the maximum yield, we find as an average of the 30 fields, a yield of 3·37 tons, or slightly more than double the returns obtained, as an average, from the unmanured

TABLE A.—RESULTS OF EXPERIMENTAL HAY CROPS SOUTHERN AND WESTERN DISTRICTS, 1902–3.

Manure Given per Acre.	1 cwt. Ordinary Superphosphate.	2 No Manure.	3 2 cwt. Ordinary Superphosphate.	4 3 cwt. Ordinary Superphosphate.	5 No Manure.	6 2 cwt. Thomas Phosphate.	7 2 cwt. Bonedust.	8 No Manure.	9 2 cwt. Ordinary Superphosphate. 3 cwt. Potash Chloride.	10 1 cwt. Sulphate of Ammonia. 3 cwt. Potash Chloride.	11 No Manure.	12 1 cwt. Sulphate of Ammonia. 2 cwt. Ordinary Superphosphate.	13 1 cwt. Sulphate of Ammonia. 2 cwt. Ordinary Superphosphate. 3 cwt. Potash Chloride.	14 No Manure.	15 2 cwt. Sulphate of Ammonia 3 cwt. Ordinary Superphosphate. 1 cwt. Potash Chloride.
District. Average of—	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Allansford .. 10 fields	6,277 1,631	4,646 —	6,433 1,787	6,430 2,102	4,328 —	6 120 1,792	5,993 1,289	4,704 —	7,140 2,436	5,488 71	4,770 —	7,803 3.033	8 201 3.270	4,931 —	9,029 4.098
Geelong .. 8 ,,	3,835 1,041	2,794 —	4,089 1,295	4.364 1,533	2,771 —	3,750 979	3,502 630	2,872 —	4,260 1,388	2,894 3 loss	2,897 —	5,246 2.349	5,048 2.013	3,035 —	5,596 2,561
Longwarry .. 6 ,,	4,241 705	3,536 --	4,538 1,002	5,165 2,070	3,095 —	4,456 1.361	4,413 843	3,570 —	6,065 2,495	4,543 1.026	3,517 —	5,782 2,265	6,638 3.431	3,207 —	7,800 4,593
Drouin .. 3 ,,	4,653 1.166	3,487 —	4,960 1,473	5,093 1,787	3,306 —	4,426 1.120	3,963 720	3,243 —	4,333 1,090	4,420 1,180	3,240 —	5,486 2,246	4,786 2,053	2,733 —	5,600 2,867
Mornington .. 3 ,,	5,270 1,326	3,944 —	5,784 1,840	6,323 2,177	4,146 —	5,038 892	5,913 2,179	3,734 —	5,453 1,719	5,634 1.673	3,961 —	7,823 3,862	7,497 3.307	4,190 —	9,351 5,161
Average of the 30 fields in lbs.	4,910 1,166	3,744 —	5,217 1,473	5,482 1.936	3,546 —	4,878 1.332	4,801 1,056	3,745 —	5,709 1,964	4,515 729	3,786 —	6,487 2,701	6 636 2,850	3,786 —	7,556 3,770
Average of the 30 fields in tons.	2·18 ·51	1·67 —	2·32 ·65	2·44 ·86	1·58 —	2·18 ·60	2·14 ·47	1·67 —	2·54 ·87	2·01 ·32	1·69 —	2·89 1·20	2·96 1·27	1·69 —	3·37 1·68

NOTE.—The large figures show the yields per acre. The small figures below these, the increase due to manures.

ground. In other words, by the application of an appropriate combination of manure, we have more than doubled the productive power of the soils experimented on. Now, such a fact as this will serve as a very good introduction to the subject I am dealing with. It will perhaps clear away a little of the prejudice which might still cling to some of you against the use of manures, and it might perhaps open up vistas of possibilities in the same direction on a class of soils owned by some of yourselves. The question as to whether these results have been obtained at a good profit—after all the principal consideration—will be gone into later on. As a first investigation, we will inquire how they have been obtained.

If you look at the head of the table you will see that the plots have been numbered from 1 to 15, and you will also find given there the manures which have been used on each plot. On plots 1, 3, 4, 6 and 7 phosphatic manures only have been used (bonedust contains a little nitrogen); that is, manures containing phosphoric acid only. In the case of northern soils, it is this ingredient only which would be required. Continuing along the plots, it will be found that on No. 9 a manure containing phosphoric acid and potash has been given. On plot 12 a manure containing phosphoric acid and nitrogen, and on plot 13 a manure containing phosphoric acid, potash and nitrogen. Now, the object of the experiment is to see if we get larger yields where these combinations have been used, and to determine the particular combination giving the maximum yield. We will first consider the figures of the general average. For comparisons, all returns will be referred to those of plot 3. On this plot, 2 cwt. ordinary superphosphate: that is, a manure containing phosphoric acid only has resulted in an average increase of ·65 tons of hay to the acre. Providing, now, the soils of the South were similar in chemical composition to those of the North, we should get no appreciable increased results, as far as grain is concerned, and probably straw also, from the addition of any other ingredient to this superphosphate. But the soils of the South apparently differ very considerably from those of the North, for on plot 12, where nitrogen in the form of sulphate of ammonia has been added, there is an increase of 1·20 tons shown. In other words, the increase has been practically doubled by the addition of nitrogen. On plot 13 again, where potash in the form of potash chloride has been added to the mixture used on plot 12, there is a further operative effect shown, for the increased yield of hay in this case is 1·27 tons, compared with 1·20. The conclusion to be drawn, then, is that the three ingredients, phosphoric acid, nitrogen and potash have all helped to produce the maximum figure of the average. Potash, to a small extent; phosphoric acid and nitrogen to a very marked degree. The relatively small effect of potash is further confirmed by the result on plot 9. The increased yield on this plot, where superphosphate and potash chloride have been used, is ·87 tons, compared with ·65 where the superphosphate alone has been applied.

But we have been dealing with the general average of five different groups of fields established in as many different centres of

the South. Do the conclusions to be drawn from the general average apply to the fields of each group? An examination of the following tables will afford an answer to this question:—

	Manured with Phosphoric Acid only. Yield in Pounds.	Manured with Phosphoric Acid and Nitrogen. Yield in Pounds.
Allansford District	6433	7803
Longwarry, Garfield, Bunyip ..	4538	5782
Geelong	4089	5246
Drouin	4960	5486
Mornington	5784	7823

An examination of the figures shows that in the group of fields of each district, the yields produced by the combination of phosphoric acid and nitrogen are considerably larger than those secured from phosphoric acid only. There is distinct evidence throughout of the necessity of nitrogenous manuring for hay crops at least. The question of potash requirements will find elucidation in the following figures:—

	Manured with Phosphoric Acid only. Yield per Acre in Pounds.	Manured with Phosphoric Acid and Potash. Yield per Acre in Pounds.
Allansford District	6433	7140
Longwarry ,, ...	4538	6065
Geelong ,, ...	4089	4260
Drouin ,, ...	4960	4333
Mornington ,, ...	5784	5453

In three only out of the five groups of fields do the yields of the phosphoric acid and potash plots exceed those of the plots with phosphoric acid only, and in one of these, the Geelong group, the excess is so small that the yields may be considered practically identical. In the two remaining groups, the yields with potash are even lower than in the plots where it has been omitted. In the Allansford district the effect of potash manuring is sufficiently marked to merit consideration in the system of manuring adopted for the soils of this group. In the Longwarry group the operative effect of potash was most pronounced, more so even than that of nitrogen. It is worthy of note that the two groups of soils on which potash has shown a decidedly marked effect, are for the most part of a light sandy nature, and it is most probable that the effective action of potash will be limited to this class of soils, and that, generally speaking, it will be phosphoric acid and nitrogen only which will demand our principal attention in the fertilization of southern soils.

Before we leave the figures of this experiment, there are still one or two minor points which claim consideration. There are, as you know, different forms in which we can give the same manurial ingredient. To take one instance, we can give phosphoric acid in the three forms (besides others), of superphosphate, Thomas phosphate and bonedust. We have done so in these experiments. It will be of interest to compare the returns in each case. The figures of the general average would appear to indicate that in the point of

increased yield the superphosphate shows a slight advantage over Thomas phosphate, and both of these a marked superiority over bonedust, using equal quantities of average samples of these manures found on the market. For 2 cwts. to the acre of each have produced increases of 1473, 1332, and 1056 lbs. respectively. The figures below will reveal to what extent the increased yields of each group support the results of the general average.

Increased yields resulting from:—

		2 cwt. Superphosphate. Lbs. per Acre.	2 cwt. Thomas Phosphate. Lbs. per Acre.	2 cwt. Bonedust. Lbs. per Acre.
Allansford Group	..	1787	1792	1289
Longwarry ,,	..	1002	1361	843
Geelong ,,	..	1295	981	630
Drouin ,,	..	1473	1120	720
Mornington ,,	..	1841	892	2179

In all cases, with the exception of the Mornington group, the returns from bonedust fall considerably behind those from either superphosphate or Thomas phosphate. In two cases out of the five, Thomas phosphate gives heavier yields than superphosphate, but in the remaining three the superphosphate shows to advantage. One fact seems clear; that is, that Thomas phosphate as a supplier of phosphoric acid compares much more favourably with superphosphate on southern soils than in the North, and experiments so far incline me to think that on the lighter soils of a sandy nature, as well as on peaty lands, Thomas phosphate of a standard equal to that used in the experiment may be finally found to claim priority over a superphosphate of a similar composition to the one employed. The numerous experiments of the present year ought to throw light on this question. The analysis of the Thomas phosphate used showed 14·79 per cent. citrate soluble phosphoric acid, and 2·37 per cent. insoluble; the superphosphate, 17·63 per cent. water soluble, and 1·55 per cent. citrate soluble.

The Quantity of Manure to Apply.

And now a few words on the quantity of manure to apply. It is just here where both caution and tact are required. Caution in not advocating an expenditure which might frighten the farmer away from the subject, and tact in advancing views which may differ considerably from his ideas. The farmer must be left to himself to decide what quantity of manure he will use. I shall not attempt to influence him. My duty ends in showing up to what quantities increased yields at a profit might be obtained. These quantities are much larger than the average farmer will for some time feel disposed probably to apply. To turn to the average returns again, it will be found that 1 cwt. of superphosphate has shown an increase of a little more than one-half a ton of hay to the acre; 2 cwt., an increase of 1473 lbs., and 3 cwt., an increase of over 17 cwt. That is, that the additional 2 cwt. of manure, costing 9s. 6d., has produced approximately 7 cwt. of hay more than the 1 cwt. The value of this 7 cwt.

at £2 10s. per ton is 17s. 6d. The heavier dressing, then, in this case has evidently proved the profitable one. But our experiments have shown us that a manure containing nitrogen, in addition to the phosphoric acid, is required for the maximum crops, and it seems probable on southern soils similar to those experimented on, that 1 cwt. also of nitrate of soda, or its equivalent in sulphate of ammonia might also result in considerably increased yields. On soils with a good rainfall requiring the two ingredients only and no potash, increased yields of 30 cwt. of hay ought to result from such a dressing. The value of this increased yield, with hay at 50s. per ton, would be 75s. Should the farmer not feel disposed to adopt such a dressing, and for the present, until we have further experimented, I do not advise him generally to do so, applications of 2 cwt. of superphosphate and ½ cwt. of nitrate of soda would probably result in increased yields of one ton to the acre, showing a profit over the cost of manure of 35s. Should even this dressing appear too heavy for him, then 1 cwt. of superphosphate and ½ cwt. nitrate of soda would probably produce increases of 15 cwt. to the acre. Of course, on the lighter sandy soils referred to requiring potash, ⅓ cwt. of potash chloride or more would also require to be added to the manurial mixtures. You will have noticed that throughout I have included the nitrogenous manure, nitrate of soda, or sulphate of ammonia as necessary. This ingredient is the most costly in the mixture. To avoid the necessity of applying this ingredient is to reduce the manure bill by more than one-half. Now, under a more scientific system of farming, and the growth of leguminous crops, capable of transforming atmospheric nitrogen into soil nitrogen of an available form, this can be done. The only substance, then, which the farmer would require to apply would be a manure containing phosphoric acid, or where required, potash also.

Summary.

Well, gentlemen, I think we can now get away from these figures. I have gone a good deal into detail in this case, in order that no further explanation should be necessary in the results from the manuring of other crops, to which I shall call your attention directly. Before dealing with these, let us review the facts which have come out in these experiments, and the lessons they have taught us.

They have taught us then, firstly, that the main requirement of all the soils experimented on, as far as hay crops are concerned, is undoubtedly phosphoric acid; that large increases result from manures containing this ingredient, and that applications up to 3 cwt. are certainly in some districts a profitable operation, dependent, of course, upon the rainfall of the particular district.

Secondly, that bonedust as a phosphatic manure cannot apparently be regarded as of equal value to either superphosphate or Thomas phosphate, taking for comparison average samples at present obtainable on the market; but that the two latter manures appear

in this respect to stand, generally speaking, upon a pretty equal footing.

Thirdly, that potash, while showing an appreciable effect on soils of a light sandy nature, cannot be regarded generally as contributing materially to increased yields on soils of a stronger type.

Fourthly, that the effect of nitrogen throughout has been of a marked nature, and that there appears evidence in the returns for concluding that applications of manures containing this ingredient will find a marked response, as far as hay crops are concerned, on southern soils generally; but the farmer is advised to procure this nitrogen for his soils by the growth and ploughing under of leguminous crops—and not by costly purchase on the market.

Fifthly, that the profits of manuring, where the maximum dressings have been given are considerable, but that the advice to the farmer for the present is to move cautiously in the matter of quantity, commencing with medium dressings, and advancing in the light of a larger experience to the heavier applications. This, then, appears to be the summary of the results of our hay manuring experiments. It must, however, not be forgotten that they are the results of one year only, and that variations in seasons and other causes might necessitate a modification of some of these views.

Summer Crops.

We can now pass to a consideration of the results obtained from the manuring of other crops, grown during the spring and summer. The hay crops, on the contrary, had at their disposal the whole of the winter rains, and were harvested early enough in the spring to escape the effects of any material shrinkage in the soil moisture. There was nothing to prevent the full operative effect of manures in their case. In the case of summer crops, the matter is an entirely different one, and it is frequently impossible to accept the results of a manure test in their case as in any way a reliable index to soil requirements. The maximum effect of a particular ingredient, or the combined effects of a combination of ingredients are prevented by an insufficiency of moisture or unfavourable temperature conditions, resulting often in returns of quite a contradictory character. These points are too commonly neglected in interpreting the results of a manure experiment. The subsoil conditions, also, showing variations even in an acre of ground little dreamt of, play a very important part in the results obtained from the various plots. One portion of the area of an experimental field affected to a greater degree than another by periods of dry weather, owing to a less retentive bottom, will frequently give results flatly contradicting those of almost adjoining plots. In looking over the results of a manure test these facts should not be forgotten. It is the results from the field as a whole which should be taken as a basis of interpretation, and the possible reasons for one or two apparent inconsistencies should not be lost sight of. It is just here where the value of large numbers comes in. In the

average of the results of these large numbers such irregularities, as a rule, are got rid of, and features common to the soils of a particular area or district—if there are such features, are brought into prominence. It is the attempted discovery of such features common to the soils of a district that constitutes the aim and the object of our experimental manure tests. After this explanation we can now examine the following table B, given on page 309, and see if the various tests have disclosed a common deficiency, or a number of deficiencies in Southern soils from the point of view of the requirements of a potato crop. Although on the whole somewhat irregular, the returns from the plots with the complete dressing show that the increased yields, taking the average of the 12 fields, are sufficient to result in very large profits. With the medium dressing on plot 3, an increased yield of 2·57 tons has been obtained as an average. Turning, however, to plot 12, where phosphoric acid only has been applied in the shape of superphosphate, and not the three ingredients of a complete manure, as in plot 3, we find an increased yield of 2·17 tons. That is, a yield nearly equalling that of plot 3, where nitrate of soda and potash chloride, in addition to the same quantity of superphosphate, as used on plot 12, have been given. Without going into a detailed criticism of the results of these experiments, it is evident that the effects of a phosphatic manure on the potato crop have been most pronounced. This is a feature common to all the soils. The extra yield shown on plot 3, with the complete manure over that of plot 12, may be regarded as due to the combined effect of nitrogen and potash. The effect, however, has been much less marked than with the hay crops, and the conclusion may, I think, be drawn that, generally speaking, the addition of these two ingredients in anything but limited quantities will not be required in seasons similar to the last except on the poorer soils, and even in their case great caution must be used with respect to nitrate of soda, which has a tendency to run the crop to top. These tests are not sufficiently numerous to generalize too freely, but the results of the present year certainly point to this direction. It is advisable in every way that the potato grower should join the Department in a wide system of co-operative experiments to test the manurial requirements of the soil generally in the South with respect to the crop.

TABLE B.—RESULTS OF EXPERIMENTAL POTATO CROPS, 1902–1903.

	1	2	3	4	5	6	7	8	9	10	11	12
Manure given per acre :—	1 cwt. Nitrate of Soda. 1 cwt. Ordinary Superphosphate. ½ cwt. Potash Chloride.	No Manure.	2 cwt. Nitrate of Soda. 3 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Chloride.	3 cwt. Nitrate of Soda. 4½ cwt. Ordinary Superphosphate. 1 cwt. Potash Chloride.	No Manure.	3 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Chloride.	2 cwt. Nitrate of Soda. ⅔ cwt. Potash Chloride.	No Manure.	2 cwt. Nitrate of Soda. 3 cwt. Ordinary Superphosphate.	1 cwt. Nitrate of Soda. 3 cwt. Ordinary Superphosphate.	No Manure.	3 cwt. Ordinary Superphosphate.
Yield per acre :—	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Mr. Cunningham, Swan Reach	10·35	5·78	9·03	10·50	5·83	8·76	6·96	6·11	9·69	7·89	5·04	9·40
Mr. J. McMahon, Bengworden	7·67	5·35	8·48	9·19	6·96	7·76	7·60	8·34	10·44	11·07	8·33	10·89
Mr. A. Gunn, Thorpdale ..	9·96	8·47	10·74	9·75	7·58	11·67	5·75	6·56	10·82	9·72	6·00	10·15
Mr. J. Grant, Trafalgar ..	9·03	7·01	8·42	7·50	5·58	5·99	6·01	5·90	6·62	8·03	6·75	8·59
Mr. W. Little, Crossover ..	3·42	3·07	4·09	4·58	2·08	4·75	2·35	2·33	4·06	5·50	2·48	5·46
Mr. Jas. Young, Longwarry ..	3·35	2·97	4·78	3·77	2·97	2·75	1·84	1·72	3·72	4·99	3·16	4·85
Mr. W. Alcorn do. ..	3·78	3·46	5·62	5·71	2·55	3·85	4·55	3·51	5·10	2·91	2·73	3·03
Mr. W. Webb do. ..	2·29	1·31	3·21	3·36	1·23	2·00	1·33	1·15	2·58	2·80	1·27	2·52
Mr. J. Watson, Garfield ..	9·97	7·02	10·32	11·02	7·08	8·40	7·29	5·89	9·80	9·34	6·80	8·01
Mr. A. Greenham, Dartmoor ..	7·01	4·07	8·33	10·34	5·00	7·75	4·90	4·73	7·36	7·99	4·64	7·17
Mr. T. Bremner, Allansford ..	6·00	3·03	5·78	7·29	2·51	4·55	3·96	2·05	3·48	2·45	2·50	3·60
Capt. Schutt, Pakenham ..	2.67	1·30	4·10	5·36	1·02	1·35	·89	·84	2·25	3·41	1·29	3·86
Average of the 12 fields ..	6·29	4·33	6·90	7·36	4·19	5·79	4·45	4·09	6·32	6·34	4·29	6·46
Increase due to Manures ..	1·06	—	2·57	3·17	—	1·60	·36	—	2·23	2·05	—	2·17

Maize for Fodder.

A large number of experimental manure fields in maize for fodder purposes were put down last year, and the tests were of rather an elaborate kind. There were 18 plots in each field, each of them the one-twentieth of an acre in area. Although circulars were sent to each of the growers, intimating the intention of an officer to visit each farm, and supervise the cutting and weighing of the plots, the great majority of the growers selfishly cut the crops from day to day for fodder purposes without keeping records of weights. In other cases, objections were raised upon the arrival of the officer to cutting such a large area at one time. In all future experiments of this kind the co-operating farmer will be bound down to conditions, and these will be insisted upon. The Table C, on page 311, gives the results from the more important plots of five such fields.

Taking the average results of the five fields, the effect of both phosphoric acid and nitrogen appears most pronounced. A comparison of the increased yields following the use of a phosphatic and nitrogenous manure will offer evidence of the operative action of each.

Increased yields resulting from—

3 cwt. Superphosphate	2·03 tons.
3 cwt. Superphosphate, 2 cwt. Nitrate of Soda	4·43 tons.

The effective action of nitrogen is again confirmed by the larger results following a larger application of this ingredient as apparent in the following figures :—

Increased yield resulting from—

3 cwt. Superphosphate, 1 cwt. Nitrate of Soda	2·82 tons.
3 cwt. Superphosphate, 2 cwt. Nitrate of Soda	4·43 tons.

That the figures of the general average in as far as they offer indications of the effect of a nitrogenous manure are in no way misleading, is brought out by a comparison of the returns on plots 12, 10 and 9 of the individual fields.

Increased yields resulting from—

	3 cwt. Superphosphate.	3 cwt. Superphosphate, 1 cwt. Nitrate of Soda.	3 cwt. Superphosphate, 2 cwt. Nitrate of Soda.
	Tons.	Tons.	Tons.
R. Farmer	1·79	4·47	5·45
J. N. Burkley	·59	·69	3·35
T. Downie	3·83	2·75	5·09
E. S. Hill	2·86	3·43	5·13
C. L. Button	1·05	1·75	3·17

The Effect of Potash.

Taking the figures of the general average, it would appear that potash had had no effect as a manure. Since the increased yield on

TABLE C.—RESULTS OF EXPERIMENTAL MAIZE CROPS, 1902–1903

Manure given per acre :—	1	2	3	4	5	6	7	8	9	10	11	12
	1 cwt. Nitrate of Soda. 1½ cwt. Ordinary Superphosphate. ¾ cwt. Potash Chloride.	No Manure.	2 cwt. Nitrate of Soda. 3 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Chloride.	3 cwt. Nitrate of Soda. 4½ cwt. Ordinary Superphosphate. 1 cwt. Potash Chloride.	No Manure.	3 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Chloride.	2 cwt. Nitrate of Soda. ⅔ cwt. Potash Chloride.	No Manure.	2 cwt. Nitrate of Soda. 3 cwt. Ordinary Superphosphate.	1 cwt. Nitrate of Soda. 3 cwt. Ordinary Superphosphate.	No Manure.	3 cwt. Ordinary Superphosphate.
Yield per acre :	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Mr. R. Farmer, Glengarry ..	11·50	10·53	11·87	14·82	11·33	13·39	12·94	11·60	17·05	15·89	11·42	13·21
Mr. J. N. Birkley, Flynn's Ck.	11·27	8·30	10·43	10·66	8·16	9·83	10.31	8·14	11·49	9·75	8 06	8·65
Mr. T. Downie, Traralgon ..	23·38	18 30	23·37	24·19	18·30	19·42	19·48	22·32	27·41	18·12	15·37	19 24
Mr. E. S. Hill, Bunyip South..	9·14	5·71	12·57	17·13	7·42	9·71	8·29	6·87	12 00	12 57	9·14	12·00
Mr. C. L. Button, Mooroolbark	2·28	1·51	4·90	4·99	1·36	3·32	1·04	1·47	4·64	3·33	1·58	2·63
Average of the 5 fields :—	11·51	8·87	12·62	14·35	9·31	11·13	13·01	10·08	14·51	11·93	9·11	11·14
	2·64	—	3·75	5·24	—	1·82	2·93	—	4·43	2·82	—	2·03

plot 3, where a complete manure has been used, is actually less than on plot 9, where phosphoric acid and nitrogen only have been applied. In the first case, taking the figures of the general average, it is only 3·75 tons; and in the second, 4·43. But in two of the fields the yields of the complete manure are heavier than the yield on plot 9, indicating perhaps an effect of the additional potash in their case, at least.

The following are the two fields referred to :—

	Plot 3. Phosphoric Acid, Nitrogen and Potash. Increase in Tons.	Plot 9. Phosphoric Acid and Nitrogen. Increase in Tons.
Hill	6·86 ..	5·13
Button.. ..	3·39 ..	3·17

These figures are sufficient to support the conclusions drawn from the results of the hay experiments that potash generally is a crop requirement playing no very prominent part as yet in the fertilization of a large number of soils of the South, and that a marked effective action from its use will probably be only noticed on the lighter soils referred to, and perhaps on certain swamp lands of a peaty nature.

Results From the Manuring of Other Crops.

A few manure tests of a similar character to those just dealt with were also carried out on a number of other crops, such as onions, mangels and pumpkins, but the returns are not sufficiently complete as yet to draw conclusions. There seems evidence, however, for thinking that the manurial ingredients which showed themselves most active in the production of the increased yields in the crops just dealt with will, in the case of the latter crops, play a similar role.

The Fertilization of Forage Crops.

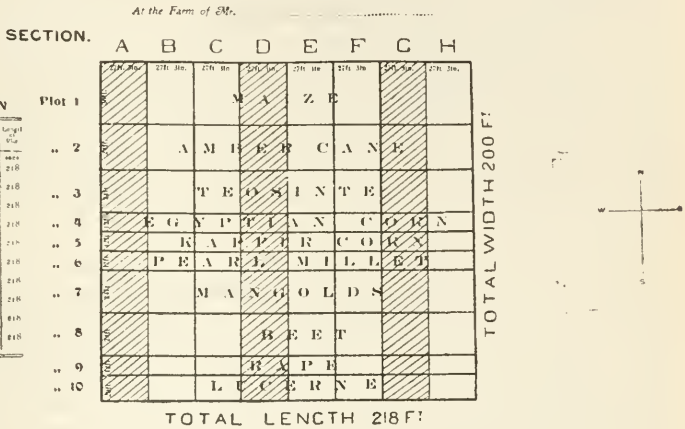
The results so far dealt with have been from plots sufficiently large to give under normal conditions reliable data as to the actual effect of the manure used, and the returns which might be expected from the much larger areas of ordinary farm practice. In addition to such experiments, manure tests were made on a very much smaller scale with a large number of forage crops, which were grown on special fields, to be described later in this paper. You find illustrated on page 313, a plan of such a forage experimental field.

You will find there are manured bands alternating with unmanured strips, extending from the top to the bottom of the field, and passing through all the crops, which cross these in parallel rows. Each crop then received the same manurial treatment, and there is, therefore, in the case of each crop a number of manured and unmanured sections. These sections, from the measurements of the plan, are, you will recognise, small in area; too small to give absolutely correct data as to either the action of the manures or the yields from the unmanured ground, since such small areas are too largely within the influence of soil irregularities, differences in germination and other causes which, in a large field, are balanced by similar irregularities of adjoining areas. When, however, we have the averages of large

numbers to go upon, the results even of areas as small as these are able to reveal certain common characteristics peculiar to the great body of soils, which may serve as indications of what manurial requirements are, without telling us exactly of the extent of those

SET X

PLAN OF EXPERIMENTAL FORAGE CROPS



NAMES OF CROPS SOWN

No. of Plot	Name of Crop	No. of Rows in Plot	Date of Sowing	Width Plot	Length Plot
			1885	1885	1885
1	Maize	12	3	30	218
2	Amber Cane	8	3	24	218
3	Teosinte	8	3	24	218
4	Egyptian Corn	8	3	12	218
5	Kaffir Corn	4	3	12	218
6	Pearl Millet	4	3	12	218
7	Mangolds	12	2	24	218
8	Beet	10	2	24	218
9	Rape	6	2	12	218
10	Lucerne	20	1	20	218

The Plots as shown on the Plans are strips 218 feet long of different widths. On the Plan they are shown as running from East to West, and are numbered 1 to 10. Each Plot is sown with a different kind of seed. Crossing the plots from North to South are 8 manured and unmanured bands or strips all of equal width, viz. 27 feet 3 inches, and 200 feet long. These strips are marked on the plan A.B.C. up to H. B.C.E.F. and H. are manured each one differently. The strips A.D. and G. shown by the shaded portions of the plan are not manured. These unmanured strips serve for comparison with the manured strips. The manures that have been sent with this plan and are marked with the letters corresponding to those on the plan are very carefully spread broadcast on the strips, B.C.E.F. and H. before any of the seeds are sown and harrowed in. The seeds are afterwards drilled in across the strips. Thus the manures are applied in this direction | The seed on each plot drilled this way —

requirements. The following figures appear to me a very fine confirmation of the conclusions which the results of the preceding experiments have forced upon us :—

RESULTS FROM THE FERTILIZATION OF FORAGE CROPS.

	Average of—	Average of Unmanured Sections.	Phosphoric Acid.	Phosphoric Acid and Nitrogen.	Phosphoric Acid, Nitrogen and Potash.
Maize	22 fields	6·19	7·88	7·97	8·41
Amber Cane	16 ,,	8·85	10·18	10·60	11·17
Egyptian Corn	9 ,,	5·09	5·88	5·91	6·16
Rape	18 ,,	12·34	14·78	15·57	17·06
Kale	9 ,,	5·29	7·22	8·55	8·69
Teosinte	3 ,,	10·23	14·66	13·69	17·26
Japanese Millet	13 ,,	6·14	7·99	9·12	9·12
Pearl Millet	6 ,,	10·51	12·51	13·91	12·84
Kaffir Corn	11 ,,	5·79	6·99	7·13	6·60
Planters' Friend	4 ,,	5·62	6·29	6·37	5·69
Lucerne	3 ,,	1·76	2·44	1·89	2·30

In six out of the eleven crops it will be seen that the maximum returns are from the section with the complete manure, that is from

the section where the three ingredients have been applied; but the yields on the section, generally speaking, are only slightly in excess of the yields where phosphoric acid and nitrogen only have been applied. In the case of the remaining four crops the yields from the complete manure are either equal to or lower than those of the adjoining plot. A comparison of the first two columns of figures—the returns from the unmanured sections—and the returns from the section supplied with phosphoric acid—will show that in every case the yield is appreciably larger in the manured section than the unmanured, and that the increase due to the application of phosphoric acid is in every instance greater than the increase due to either nitrogen or potash. An examination further of the third column of figures will disclose the fact that in nine cases out of the eleven, the addition of nitrogen to the phosphoric acid has resulted in still further increases to the yield.

The returns generally then appear to support the results of the preceding experiments. Seasonal differences may introduce slight variations into the operative effect of the various manures, but as far as the tests of one year will allow of the expression of opinion, it seems certain that large increases in yield will follow the application of phosphatic and nitrogenous manures only to most of the crops specified, but that on certain areas the maximum results can only be obtained by the further addition of potash. The solution of the soil requirements for the whole of the South depends upon the support given by the farmer to the further experimental work of the Branch. The more immediate investigations should deal with the fertilization of the grain crops grown in that area.

The Economic Aspects of the Results.

The economic aspects of the results have barely been referred to. Attention was certainly directed to the large profits resulting from the manuring of hay crops. But the result of such experiments have a far wider application, for they point to a large possible improvement of pasture lands, and a marked increase in carrying capacity. They mean as well a sweeter herbage, a more nutritious herbage, and a healthier beast, free probably from the vitiated appetites that can only be accepted as signs of some deficiency. They mean a greater production of beef, a larger output of milk, butter, cheese and wool, and an increase in the productive power of the land generally. The manuring of the southern soils is a subject certainly deserving both the attention of the farmer and the consideration of the Department.

BEET EXPERIMENTS.

With the keen competition of the present, and the rapidity with which a highly profitable industry may through similar developments elsewhere become a poorly paying or even an unprofitable undertaking, it should be the work of an Agricultural Department to continuously investigate the possibility of new lines of agricultural enterprise, and search out the special advantages which attach to a particular district or a particular country as the home of certain industries. As an effort in this direction, investigations to determine the adaptability of Victoria generally to the growth of the beet of a sugar percentage sufficiently high to give promise of successfully establishing the industry—finds every justification. The closing of the Maffra factory must not be accepted as the final chapter in the beet sugar question in Victoria. Seventy years of effort, and a succession of failures preceded the establishment of the first beet factory as a commercial success in America. We must not accept the failure of Maffra as proof positive that nothing but failure can follow a second attempt. With the view of keeping the question still to the front, and testing the adaptability of southern Victoria generally for the growth of the crop, seed sufficient for an acre was distributed to nearly 400 farmers. In nearly 200 cases the seed was put in by my officer. The seed was supplied ostensibly as a test for fodder purposes, but I availed myself of the splendid opportunity presented for testing the sugar percentage. Average samples of the root were collected by my officers. These roots were taken from a large number of places in the field, topped, dressed and weighed, and the average weight of the root calculated. The number of roots to the chain was determined in ten different parts of the field, and the average in this case also taken. From these figures a very close approximation of the yield per acre was obtained by calculation. There were 156 fields visited and treated in this manner. Samples in each field carefully packed to prevent loss of moisture were sent to the laboratory and analysed. The Table D, on page 316, shows the results of the examination.

It will be seen that the 156 fields have given an average yield of 14½ tons, of a sugar percentage of nearly 15, and a purity of over 81, but fine as these results are, as a general average, they are considerably exceeded by the returns obtained from the area extending from Maffra to Traralgon, the area to which we must mainly look for supplies if the factory is to be opened again. I give the results of the first and second analyses of the roots in this area. (See Table E, on page 317).

The results of these investigations will be fully dealt with in a special report, but I might here remark that the splendid average yield of nearly 16½ tons of dressed roots, a sugar percentage of nearly 16, and a purity of 83, are figures which will appeal to those who still retain a belief in the possibility of establishing another great agricultural industry in Victoria.

TABLE D.—RESULTS OF THE EXPERIMENTAL BEET PLOTS IN THE GIPPSLAND AND WESTERN DISTRICT IN 1902–1903

District		Average Number of Roots per Chain.	Average Weight of Root in Grammes.	Estimated Yield per Acre in Tons.	Sugar in Root.	Purity.	Value of Crop per Acre at Former Factory Prices.	Remarks.
							£ s. d.	
Maffra—Briagolong ..	Average of 17 fields ..	53	716·76	17·26	15·6	81·47	14 9 8	
Heyfield—Dawson	,, 14 ,, ..	61	666·22	17 87	16·4	80·35	16 19 7	
Cowwarr—Toongabbie ..	,, 21 ,, ..	48	816·70	15·41	15·4	83·65	12 13 9	
Traralgon—Flynn's Creek ..	,, 13 ,, ..	49	768·77	15·99	16·3	85·31	14 11 0	
Mirboo—Moe—Thorpdale ..	,, 12 ,, ..	48	639·30	12 70	13 3	81·99	8 19 5	
Trafalgar	,, 11 ,, ..	54	638 61	16·32	14·2	83·33	12 2 10	
South Gippsland	,, 10 ,, ..	58	442·82	10·74	15·0	84·29	9 3 0	
Geelong	,, 15 ,, ..	37	396·77	7·11	16 6	78·76	6 13 5	
Colac	,, 6 ,, ..	49	664·81	15·11	13·0	76 56	9 13 4	
Terang	,, 6 ,, ..	58	442·18	12·27	13·8	78·38	9 4 10	
Port Fairy	,, 12 ,, ..	71	518·80	14·86	13·7	80·69	10 8 1	
Heywood—Condah	,, 13 ,, ..	76	548 04	19·61	13·8	80·48	13 3 10	
Casterton—Coleraine ..	,, 6 ,, ..	55	498·04	13·53	15·5	84·80	11 12 6	
Average of the 156 fields		54	619·65	14·72	15·0	81·83	£12 0 1	

TABLE E.—RESULTS OF EXPERIMENTAL BEET PLOTS IN 1902–1903

Averages of Fields, embracing the MAFFRA, BOISDALE, STRATFORD, BRIAGOLONG, HEYFIELD, DAWSON, COWWARR, TOONGABBIE, GLENGARRY, FLYNN'S CREEK and TRARALGON Districts.

District.		Average Number of Roots per Chain.	Estimated Weight of Root in Grammes.	Estimated Yield per Acre in tons.	Sugar in Root.	Purity.	Value of Crop per Acre at former factory prices.	Remarks.
First Round.								
							£ s. d.	
Maffra—Briagolong	Average of 21 fields ..	55	514·88	12·417	18·0	83·48	12 13 6	
Heyfield—Dawson . ..	,, 20 ,, ..	63	581·06	15·288	16·9	82 20	14 15 3	
Cowwarr—Glengarry ..	,, 22 ,, ..	48	731·03	13 168	17·2	83·26	13 3 11	
Flynn's Creek—Traralgon ..	,, 15 ,, ..	48	631·63	13·702	17·4	84·81	13 8 6	
Average of the whole 78 fields—MAFFRA to TRARALGON		50	615·26	13·61	17·4	83 52	£13 11 7	
Second Round.								
							£ s. d.	
Maffra—Briagolong	Average of 17 fields ..	53	716·76	17·26	15·6	81·47	14 9 8	
Heyfield—Dawson	,, 14 ,, ..	61	666·22	17 87	16·4	80·40	16 19 7	
Cowwarr—Glengarry ..	,, 21 ,, ..	48	816·70	15·41	15·4	83·65	12 13 9	
Flynn's Creek—Traralgon ..	,, 13 ,, ..	49	768·77	15·99	16·30	85·31	14 11 0	
Average of the whole 65 fields—MAFFRA to TRARALGON		52	748·57	16·49	15·9	82·70	£14 9 0	

FORAGE EXPERIMENTS

Forage crop experiments formed a new line of investigation in the field operations of the Branch of last year. The value of such investigations in the interests of the dairy industry will be recognised. Maize has been the one annual crop tried in Southern Victoria as a summer fodder for dairy cows, and even this crop appears to be grown for this purpose to a very limited extent. The facts that have come out in the results of the experiments disclose the adaptability of Southern Victoria for a very wide range of crops, and the possibility generally of producing immense yields. Reference again to the plan of experimental forage fields, to which attention was directed earlier in this paper, will indicate the system on which the crops were grown. The system adopted of growing a number of plants of similar characteristics side by side, under exactly identical conditions of soil and climate, enabled the comparative yields of such crops to be obtained. The following figures show the comparative yields of maize, amber cane, Kaffir corn, Egyptian corn, and Planters' Friend, taking the average of a large number of fields :—

	Maize. Tons.	Amber Cane. Tons.	Kaffir Corn. Tons.	Egyptian Corn. Tons.	Planters' Friend. Tons.
Average yield per acre of 14 fields	12·83	14·64	9·67	7·83	—
Average yield per acre of 5 fields	11·48	—	—	—	13·48

All these crops, with the exception of maize, belong to the sorghum family. Kaffir corn and Egyptian corn gave lower yields than maize. The yields, however, from the amber cane and Planters' Friend were higher than those of maize. Both amber cane and Planters' Friend are spoken of very favourably by the great majority of growers, and from the larger yield, greater palatability and greater endurance of hot, dry spells seem by many to be preferred to even maize. An additional claim to priority over maize, in the opinion of many possessed by sorghums, is the large yield obtainable as a second cut. The following results of a second cut in a field which may be considered typical of a large area in Gippsland are interesting in this respect :—

	Returns per Acre from Second Cut. Tons.	Total Yield per Acre from 2 Cuts. Tons.	Returns per Acre from Maize 1 Cut. Tons.
Amber Cane	10·26	29·30	23·57
Kaffir Corn	10·36	28·17	—
Egyptian Corn ..	8·78	23·10	—
Planters' Friend ..	12·60	38·47	—

There is every evidence that both amber cane and Planters' Friend will be extensively grown as summer fodders in the South of Victoria. The limits of this paper will not allow of my going into detail on the results of the forage experiments. These have been fully treated of in a separate publication, but I would specially direct your attention to one crop which I am sure will be taken up as a favourite through the whole of the South. I refer to the Japanese millet. Remarkably quick in growth, fine in stem, of good leafiness, nutritious, and highly palatable, it gave great satisfaction in nearly every instance in which it was grown, and I consider it a most

valuable addition to the forage crops of the South. The beet is also a fodder which has throughout done well. It is spoken of by many with almost enthusiasm. In addition to its fine feeding qualities for the dairy cow, it has the special advantage of filling the gap when other crops are done. The rape has given enormous yields, and has generally proved so successful that there is probably no part of the world better adapted for its growth. The possibilities of this crop in the production of pork and mutton have not yet dawned upon the Southern farmer. If the experiments of the past year had done nothing more than bring this crop into prominence, sufficient to justify the expenditure of the whole work would have been accomplished.

Conclusion.

I have attempted in the time at my disposal to give some explanation of the field operations of last year. All this work was carried out in co-operation with farmers, and without the opportunity of preliminary investigations of any kind at a Government Station. The advantage of such a station will not be questioned. The farmer is hardly the best judge of the value of experimental work. Investigations which end successfully on his farm, and provide him with new facts which can immediately enter into his agricultural practice are naturally regarded with favour, but for the large percentage of failures which of necessity must enter into all experimental work, he has little sympathy. He appears to forget there is a great value attaching even to negative results. Where the experimenter has to make leaps in the dark, he is apt to suffer some injustice, and find his work discredited. But the splendid results of the past year have even justified such risks, and the new crop of facts which we can now offer the farmer will, I think, appeal to him as of great value. It is important he should learn something of the manurial requirements of his soil for the various crops he grows. The work of the past year has attempted to provide this knowledge. It concerns him just as much to know the adaptabilities of his district for untried crops, tending to advance industries already established, as well as indicating possible developments in other directions. Here also the Chemical Branch has been active, and I think I can claim successful. The farmer, in the broad sense of the word, the dairyman and the grazier in the narrower, must benefit by every fact pointing to a possible increase in the productive power of the soil. The increase in the yield of farm crops generally, as indicated by the fertilization experiments, the improvements of pasture lands following a similar treatment, the improved prospects of the dairy industry through a proved, possible, continuous supply of succulent forage through the long summer months, and the conclusions to be drawn from the beet experiments are all facts pointing towards the goal of a more progressive Agriculture. I wish you to regard these facts in this light, to support the efforts which are being made by the Department to further your interests, and to ask that there shall be no starving of institutions engaged in the great work of agricultural education and investigation.

THE MODERN SILO.

By T. Cherry, M.D.

The Necessity for Silage.

Animals which chew the cud differ from all other classes in requiring their food comparatively juicy and bulky. Their digestive apparatus is formed to suit this kind of food. Hence the cow or bullock cannot thrive on exclusively dry food so well as the horse. In Victoria it is almost the invariable rule that green food completely disappears from December till the autumn rains, while in many districts it happens that there is little green grass for six or eight months in succession. In the northern areas there is often abundance of trefoil, grasses, and self-sown crops going to waste in October and November. In the south the maize crop cannot be eaten by the dairy herd so fast as it matures. Any method by which these green fodders can be preserved in the succulent condition is well worth the attention of the farmer. It will enable him to utilise his hay and straw to best advantage, and carry the stock through periods of drought with comparative ease. By a combination of dry and succulent food the largest amount of nutriment is extracted from both. In some districts green fodder and roots can be grown, and these may take the place of silage, but in all cases it is a great advantage to be able to secure the crop just when it is in the best condition, and there is no question that, except where irrigation is practicable, the silo will come to be regarded as indispensable on every progressive farm.

The Cause of Former Failures.

Up to the present, silage has not been a success in Australia. Many farmers have tried the stack and pit, but few have continued to use them. The reasons are, first, the degree of uncertainty as to how the silage will turn out, and second, the unsatisfactory feeding results often obtained.

The conditions necessary to ensure good silage were laid down by Gilbert and Lawes in 1886. They pointed out the necessity for excluding the air, and the consequent advantage of first chaffing the green stuff. Unfortunately many men jumped to the conclusion that any kind of stack or heap would do if sufficiently weighted, and disappointing results have followed. When green stuff of any kind is put together in a heap, a rise of temperature ensues. This rise of temperature shows that combustion of some kind is going on, and unfortunately the material which first disappears from the silage by this combustion is the sugar, which forms one of the valuable food substances contained in the crop. Oxygen from the atmosphere is absolutely necessary to keep up the combustion, and hence the key to the production of first-class silage is the complete exclusion of the

air. To make any mass of green stuff fill all the interstices it requires to be chaffed—hence the stack is out of the question for permanent purposes. The more readily air can gain access, the greater will be the destruction of food materials. A deep silo is therefore better than a shallow one, and round is a better shape than square or rectangular. A round silo is not only stronger, but there are no corners to keep the mass from settling down uniformly. If these conditions are fulfilled there is no uncertainty with regard to the result.

Essentials for Success.

To obtain the best possible results we require (1) to cut the crop up small, so as to allow it to be pressed into a solid mass; (2) to have the silo air tight; (3) to have it built so as to offer no obstruction to the uniform settling of the silage. Granted these conditions are fulfilled, it does not matter whether the silo is above or below ground. It is merely a question of convenience and economy. The framing must be rigid and strong to resist the great internal pressure, while the inside must be lined with some material impervious alike to air and moisture. It is practically impossible to build a square wooden frame sufficiently strong to resist the pressure without bulging in some part. Very frequently they crack at the corners. A wooden frame must be made on the same principle as a cask, the strength being secured by what corresponds to the hoops. If the silo is dug out below ground, it should be circular in shape, the walls perpendicular, and as smooth as possible. Projecting buttresses inside, and partitions of any kind are to be avoided. Brick and stone or concrete make first class silos, but they must be properly lined, and they are much more expensive.

Probably the most satisfactory method is to build a wood silo on a brick foundation, the latter extending say 5 feet into the ground. The wood frame and hoops are to be erected in the way described below, and will remain as permanent parts of the structure. The inside lining and outside covering may be modified to suit the ideas and purse of the proprietor. These details will be discussed later on. The cheapest lining is ⅞-wood, covered on the inside with acid-proof paper. Several brands of paper are on the market, and the thinnest will last two or three years. Next to paper comes plain sheet iron, either black or galvanised. This requires to be coated with ruberoid or suitable paint to resist the acid. The iron may be substituted for the paper lining after the latter has served one or two years, and the farmer is convinced of the value of the silo. For the first year or two no covering is needed beyond a coat of tar on the outside of the lining boards, but later on the outside may be covered with weatherboards or with sheet-iron.

In suitable localities, the cheapest of all is a good pit, the earth from the excavation being used to form a bank around the top, and thus increase the total depth. On many farms such a silo can be prepared in a week or two, the whole cost being simply the labour involved, and hardwood planks for lining the upper half.

Location of the Silo.

The silo should be convenient to the cow shed and other buildings, and also to the horse works, so that the chaffcutter may be easily used. As the chaffed material must be filled in at the top, an elevator is usually necessary. Where the buildings are on the side of a hill, a space may be cut out, and the earth used to form a platform for the chaffcutter, and thus the length of the elevator is less. The port-holes should be arranged so that the silage may be emptied down a canvas shute into a truck running to the feeding shed. The arrangement shown in Fig. 1 is a pit silo, combined with a hay loft over the cow stalls. It is most convenient for chaffing the green maize when filling the silo, and for mixing the silage with oaten chaff when feeding to the cows. It is slightly modified from the one in use on Mr. Stockdale's farm, Warragul.

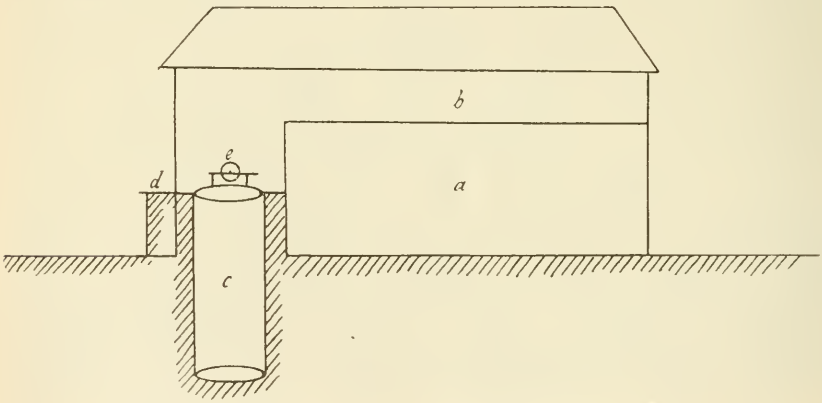


FIG. 1.—(*a*) Cow shed; (*b*) hay loft: (*c*) silo; (*d*) platform: (*e*) chaffcutter.

One-half of the width of this end of the building is occupied by the silo, the other half serves for a place to mix the food. Another convenient method is to place the silo at an angle of the farm buildings, and run a light tramway to the different lines of feeding stalls.

Directions for Building a Silo.

DIAMETER, 13 FT.; HEIGHT, 25 FT.; CAPACITY, 55 TONS.

SEE FIGURES 2 AND 3.

The following materials will be required:—

16 pieces	..	2 feet	..	6 x 6 Redgum Stumps
15 ,,	..	15 ,,	..	4 x 2 Hardwood Studs
15 ,,	..	12 ,,	..	4 x 2 ,, ,,
15 ,,	..	15 ,,	..	4 x 1½ ,, ,,
15 ,,	..	12 ,,	..	4 x 1½ ,, ,,
48 ,,	..	15 ,,	..	4 x 0½ ,, Battens
8 ,,	..	5 ,,	..	9 x 3 ,, Plates
1,300 feet run	..	9 x 6-out		Spruce Lining
50 ,, ,,	..	6 x ⅞ T. & G., white		

1 roll P and B paper, or
56 sheets .. 6 x 3 x 26 gauge Plain Iron.

Fig. 2. SILO IN COURSE OF CONSTRUCTION
STUDS AND HOOPS IN POSITION, LINING HALF FINISHED.

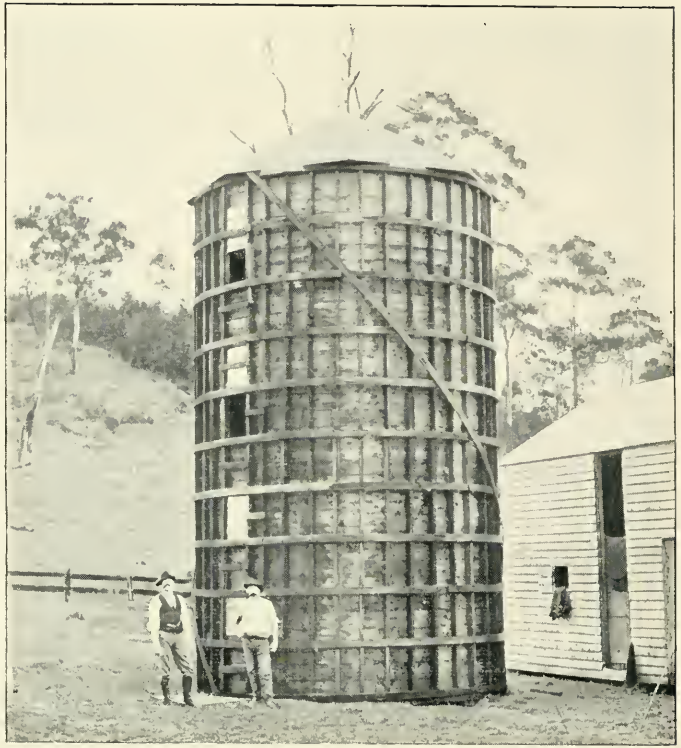


Fig. 3. SILO COMPLETE.

A suitable site having been selected, and levelled if necessary, place a stake in the centre of this space, and with a lath 7 feet long, describe a circle 13 feet in diameter. This circle then forms the outside of the line of the stumps. Fix the stumps at equal distances round this circle, about 2 feet 5 inches from centre to centre. The tops should not project more than 6 inches above the level of the ground, and they require to be well rammed, as the stability of the silo against the wind is largely dependent upon the way it is fixed to the foundations. Mark on the top of the stumps a circle with a radius of 6 feet 4 inches, and fix the 9 x 3 plates in position, so that the outside of each plate at the middle of its length comes flush to this circle, and the ends project beyond it. The line by which to cut each plate, in order that they may form a regular octagon, may be found by laying on it the lath from the centre peg. The exact length of the outside edge of each plate will be found to be 4 feet $11\frac{3}{4}$ inches. The plates are then securely spiked or bolted to the stumps.

Next mark on the plates two circles with a radius of 6 feet 4 inches and 6 feet 2 inches respectively. The inside one is the line of the inside of the silo. The 4 x 2 studs are then halved for 4 inches at one end, and their positions are marked on the outer circle 16 inches apart. There will be one space a couple of inches wider, which will serve for the port holes. Where necessary, the plates are checked out to the 6 feet 4 inch line, so as to take the end of the studs, the inside edge of the studs thus standing true to the 6 feet 2 inch line all round the silo. In fixing the studs in position, care must be taken to keep them plumb both ways, the 12 feet and 15 feet studs being placed alternately. When 8 or 10 of them have been braced in position, fix on temporarily two or three of the inside lining boards, and then nail on the battens to form the first hoop 18 inches from the plate. As it takes three battens to go round the whole silo, the ends should not be butt-jointed on the same stud, but should overlap by at least one stud. When the battens are fixed so as to complete the hoops to a height of 12 feet, the top studs, 4 x $1\frac{1}{2}$, are nailed on to the sides of the 4 x 2's, about 2 feet being allowed for the lap. The outside hoops are made to "break joints" as much as possible so as to add to the strength of the structure. The same applies to the $\frac{3}{4}$ inside lining; but in this case "butt joints" are made on each stud, so that the inside surface may be finished perfectly smooth. The paper may be tacked on in horizontal strips at the time of filling.

The port holes are made at intervals of 4 feet vertically, and should be about 18 inches square. The doors are made of a double thickness of 6 x 1 T. and G. Three 18-inch lengths are placed side by side, and three similar pieces nailed cross-wise to them with a sheet of P. and B. paper between. The stops to receive the doors are made of 3 x 1, nailed to the sides of the two studs which form the jambs, so that the inside of the door is flush with the inside of the silo. The sill and lintel to complete the port-hole may be made of

3 x 2 hardwood. The doors are placed in position as the silo is filled. The weight of the silage keeps them secure, and they are knocked back into the silo as each becomes exposed by the silo being emptied from the top. Great care must be taken that the joints exclude all air and water, as the silage is often damaged at the port-holes. The doors should be covered on the inside with a sheet of P. and B. paper with a good lap, and the joints may be luted on the outside with clay if necessary.

The roof may be left until the silo is filled. In dry districts a thatch of straw will be sufficient, but the best method is to adopt the circular conical roof. Make a light frame from the tops of the studs to a centre post, and cover it with iron or ruberoid. A top plate marked and cut out exactly the same as the bed plate, but made of lighter material, is useful for keeping the studs upright during the erection of the frame.

Silos built in the way here described were erected last season by Messrs. Galbraith and Sons, Tyers, Traralgon, and by Mr. Chalmers, Leongatha. The total cost, including labour, was £17. Figs. 2 and 3 show this silo in course of erection and complete.

Larger and more expensive silos are shown in Figs. 4 and 5. The former was erected by Mr. W. J. Wilson, for Mr. J. H. Riley, Outtrim. It is 22 feet in diameter, and 23 feet high. The superstructure is set on 5 feet of brick work, cemented on the inside. The studs are 4 x 2, covered on the outside with white pine weather boards rebated. Inside lining, one thickness ½-inch spruce, one layer P. and B. paper, and finally plain galvanised iron. Arrangements are made for the drainage of the concrete floor. The cost was £50. Last summer it was two-thirds filled with the maize crop off five acres.

Fig. 5 is the silo built in 1902 by Mr. G. F. Syme, Dalry, Healesville. This silo is covered with galvanised iron on the outside, in place of weatherboards. Mr. Syme supplies the following particulars :—

"The pit has been in every way a success, and the ensilage turned out in perfect condition, with the minimum amount of waste. The lower portion is of bricks laid in cement beneath the ground level, with a lining of cement, the portion above ground being built of timber studs of hardwood, 4 inches by 2 inches, and 14 feet long, lined inside with 6 x ½ lining, then a lining of ruberoid 2-ply paper, and finally galvanised iron sheets, with a coat of ruberoid paint applied. The total depth of the silo from the eaves to the floor is 24 feet, 14 feet above ground, and 10 feet of brick work below ground. The roof is sixteen-sided, with a ventilator on top. The interior diameter of the silo is 25 feet in the clear.

"On one side is the door through which ensilage is elevated from the chaffcutter to the top of the building; on the side towards the milking shed there are three doors for taking out the silage for feeding purposes. The silo will hold over 200 tons of made silage.

Fig. 4. SILO IN BRICK FOUNDATION, OUTSIDE WALLS WEATHERBOARD.

Fig. 5. SILO IN BRICK FOUNDATION, OUTSIDE WALLS PLAIN GALVANIZED IRON.

No weights were used, the top part when filled being thoroughly trampled and levelled, then watered to make a mould which seals the ensilage, making an airtight covering. The outside of the silo is sheathed with plain galvanised iron. The plan of the silo is founded on an American model, but stronger in design, and heavier timber was used for the sills and studs than specified in the American plans."

Ruberoid paint protects the iron perfectly from the action of the acid. The silo should also be limewashed inside just before filling. Brick, concrete, and masonry are largely used in the United States for the silo, but as our object at present is to point out what can be done at the least expense, and yet give very satisfactory results as regards the silage and at the same time serve for the frame work of a permanent structure.

For a silo 25 feet high, if built from the ground level, the elevator from the chaffcutter requires to be 30 feet long. The easiest way to make the elevator is V-shape, as shown in Fig. 6a.

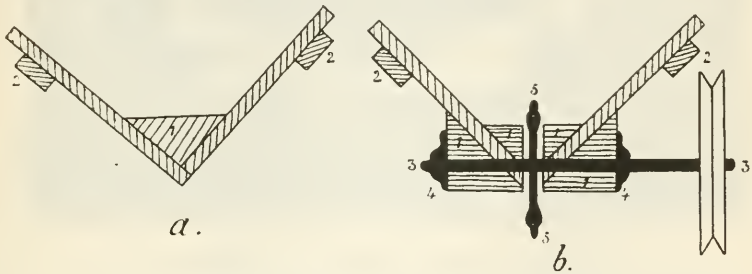


Fig. 6.—(*a*) Section of elevator; (*b*) top end of elevator; (1, 1) angle rails; (2, 2) battens; (3, 3) spindle; (4, 4) bearings; (5) sprocket wheel.

12 x 1 boards are nailed to the sides of an angle rail, the joints being broken, and battens nailed along the outside to stiffen the long length. A reaper and binder chain belt is arranged to run over a sprocket wheel at top and bottom, and the flaps are made of wood or sheet-iron and rivetted on to the joints of the chain. By fixing a grooved pulley to the spindle of the top sprocket the elevator may be driven from a similar pulley on the chaffcutter by means of a rope belt. The sprockets run in slots sawn out of the angle rail, and the sides are strengthened by three feet of angle rail nailed on each side, as shown in Fig. 6b.

The Circular Pit Silo.

The pit silo has not given universal satisfaction chiefly for two reasons, the shape is usually square or rectangular, and often divided into a number of compartments, and secondly the silage is not generally chaffed. The disadvantages of both these features have already been pointed out. They all tend to promote fermentation by making it difficult to exclude the air. The pit should be circular, excavated in the same way as a round tank, if possible with perpendicular sides, while the depth should be increased by using the earth to bank up the superstructure. The simplest method to do this is as follows:—Mark eight logs, each 8 or 10 feet long, and about the dimensions of

a railway sleeper, with a line forming part of the required circumference in the same way as the bed plate of the overground silo was set out as described above. Adze the sleepers to this curve, and set them true to the circle, as shown in Fig. 7. This circle is 2 or 4 inches larger than the pit to allow for the thickness of the vertical lining.

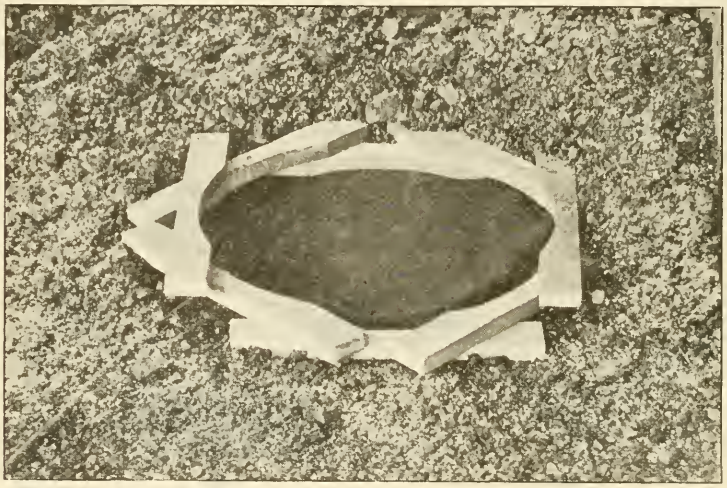


FIG. 7.—Sleepers adzed to circle in position at top of pit.

The earth is thrown out clear of the circle until the silo is excavated the necessary depth. The next step is to get the lining in position before ramming the earth round it. Red gum 6 x 1 or 9 x 2 makes the best lining, the latter being preferable. Spike 8 of the lining planks to the sleepers equal distances apart, and brace them vertical. A light top plate is then adzed to the same circle as the sleepers. Suitable timber for this plate is 9 x 3. Nail the sections of this plate lightly to the eight vertical planks, and then begin to nail the lining in its permanent place. Keep the joints as close as possible, and when the first of the temporary planks is reached it may be necessary to take it off and replace it tight up to its neighbour. Continue in this way till all the planks are in position, and then ram up the earth from the outside. In this manner from 4 to 10 feet may be added to the depth of the pit. When finished all the joints are smoothed off with clay, and the earth walls of the pit may be treated in the same way if they are not smooth. In order to secure a perfectly smooth surface it is worth while lining the whole pit with single-ply P. and B. paper. One or two doors may be made in the superstructure in the way already described. The total depth of the pit silo should be at least 18 feet. The advantages are ease and economy of construction, and of filling, the chaffcutter being placed over the top. The disadvantages are liability to damp and the labour involved in hoisting the silage out. The first can be met in most districts by placing the pit under a roof, say at one end of the

cow stalls, and two or more doors in the superstructure reduce the labour considerably.

A section of a good pit silo is shown in Fig. 8. In filling a deep pit caution is required in respect of the carbonic acid gas, and the green stuff should be allowed to fall into it from the cutter for a few minutes before anyone descends to tread down the silage. If the pit is less than 18 feet in depth means should be adopted for weighting the material when first put into the silo. A covering of bags, and two feet of earth or stones will serve this purpose.

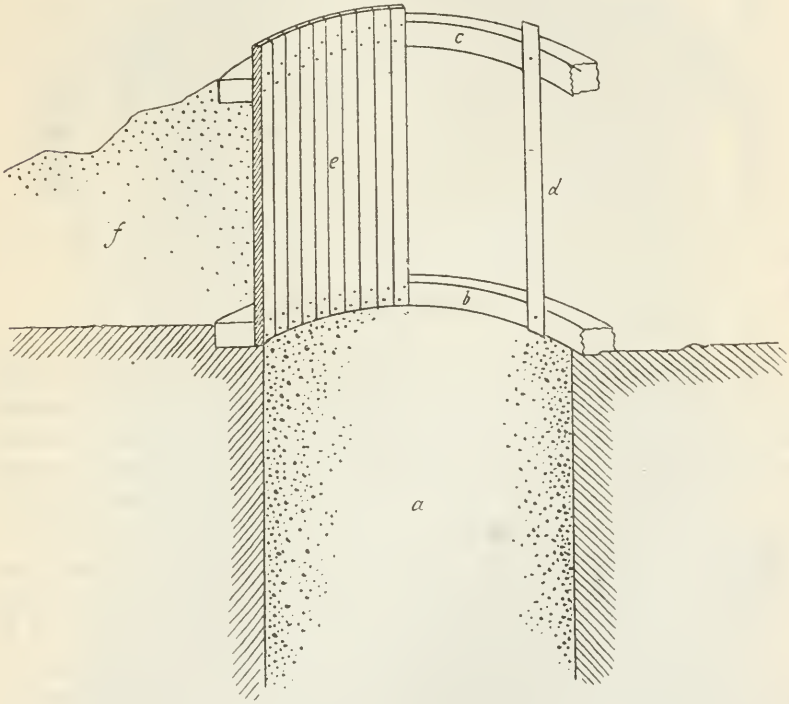


Fig. 8.—(*a*) Interior of pit; (*b*) bottom sleeper; (*c*) upper frame; (*d*) temporary plank; (*e*) permanent lining; (*f*) earth banked up.

The Stave Silo.

The stave silo is not so well adapted to Australian as to American conditions, on account of the way our hardwoods shrink and warp as they dry. If built of Oregon or red deal the expense is much greater than a framed silo built in the way already described. The one shown in Fig. 9 was erected last year by Mr. Carpenter, Heywood. It gives first class results as far as quality of the silage is concerned. The dimensions are 13 feet diameter, and 20 feet high. The cost was about £50.

Capacity of Silos.

The following table shows the calculated capacity in tons of round silos, adapted from King. In the larger sizes the actual capacity is probably considerably greater on account of less friction in the walls.

Depth. Feet.	Inside Diameter in Feet.				
	12	15	18	21	24
20	34	52	75	103	135
22	38	60	86	117	154
24	42	68	98	133	180
26	48	76	110	150	200
28	54	85	122	166	220
30	60	95	138	184	240
32	68	105	155	204	270

Filling the Silo.

Considerable difference of opinion exists as to the rate at which the silo should be filled. Some hold that it is best to fill it as rapidly as possible, so as to get the pressure on at once. Most farmers, however, find that perfectly satisfactory results are attained by filling at the rate of 4 or 5 feet a day. Very often the horses are employed cutting and carting the crop in the morning, and in working the chaffcutter in the afternoon. The maize is usually cut ¾ inch long. As the silo is filled, it should be continuously tramped as thoroughly as possible, especially at the sides. There is some danger of the carbonic acid gas collecting after the first day or two if the silage is more than 4 feet below the first open port-hole. This danger is greatest in the pit silo, and the workmen should not go into them to resume trampling until the machinery has been running for some minutes. As the silage drops into the pit it will stir the air, and cause the carbonic acid gas to escape. The gas accumulates most during calm nights. No weights are required if the silage is more than 16 or 18 feet in depth. The loss in the upper part is greater than at the bottom, so that it is always an advantage to add the weight, if this can be easily done; but the layer of moulds which forms on the top excludes the air pretty effectively, and the owners of a good silo rarely think it worth the trouble of putting on the weights by means of stones or earth.

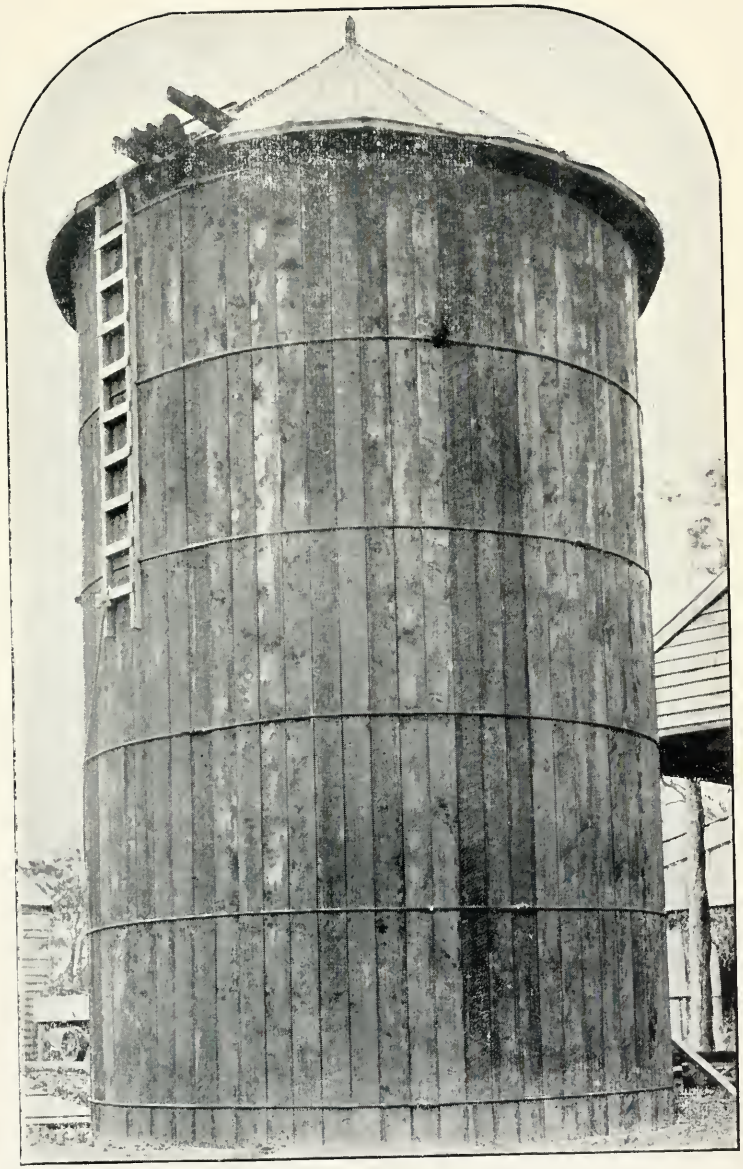


FIG. 9. STAVE SILO.

The Position of Silage as a Food.

COMPARATIVE ANALYSES.

—	Water.	Digestible Nutrients in 100 lbs.		
		Protein.	Carbo-Hydrates.	Fat.
Californian Analyses (1)				
Barley	74	1·8	12·7	0·9
Clover	72	2	13·6	1·0
Maize	75	1·3	13·5	0·6
Oat	72	1·5	14·8	0·9
Orchard grass	77	1·1	10·6	1·0
Average American Analyses (2)				
Maize	79	0·9	11·3	0·7
Sorghum	76	0·6	14·9	0·2
Lucerne	72	3·0	8·5	1·9
Grass	68	1·9	13·4	1·6
Maize and Sorghum ...	76	1·6	13	0·7
Victorian Analyses, 1903 (3)				
Maize, No. 1	75	1	14·6	0·8
,, ,, 2	80	0·9	10	0·9
,, ,, 3	81	0·9	9·6	0·8
,, ,, 4	80	1	10·5	0·8
,, ,, 5	82	0·7	5·3	0·4
Sorghum	78	1·2	11·3	1·3

(1) University of California, Bull. 132.

(2) Henry, p. 243.

(3) Chemical Lab. Dept. of Agriculture.—In calculating the digestible nutrients from the total amount of each constituent present, I have averaged the co-efficients of digestion.—T C.

It will be seen that silage is rich in sugar, but poor in the flesh-forming constituents, with the exception of that made from the leguminous plants. Hence it cannot be expected to keep cows in first rate milking condition unless supplemented with drier food containing a higher percentage of protein. Oaten, lucerne, or clover hay is the readiest and most economical method for the farmer to supply this requirement, and silage mixes well with grain of all kinds, bran, oil cake, and other concentrated foods. It must also be remembered that in the cold weather the cow requires something more than bulky succulent food. Just as in the summer, the dry requires to be supplemented with juicy food, so in the winter the silage should be fed along with hay or similar material. The art of the farmer consists not only in supplying the proper amount of food, but in furnishing the animals with the food best adapted to their requirements.

From 30 to 40 lbs. a day is about as much as the average cow can utilise to advantage. This amount furnishes about one-seventh of the protein, and from one-third to one-half of the carbo-hydrates that the cows requires when in full milk. Sixty tons of silage will supply 30 cows for four months, provided it is supplemented as described above.

Crops for the Silo.

The best silage is made from plants with a solid stem, as maize, sorghum and amber cane, while with these crops there is the further great advantage that the whole of the stem, if the material is chaffed, becomes so soft and succulent that none is wasted by the animals. Considering also the total yield per acre, there is no question that where a crop is specially grown for the silo one of these should be chosen. The hollow stem of the cereals contains air, and this increases the loss by fermentation, even when chaffed; but in spite of this defect there is no better way of utilising a crop of rye or barley grown for fodder, which has become over ripe to be relished by the cows. If other methods of securing green fodder are available, oats, wheat, and the mixed grasses and clovers are better made into hay. Cabbage, rape, and roots cannot be preserved as silage. In the North the abundant trefoil, barley-grass, and self-sown cereals should be made into silage, because in most cases this is the best way to secure succulent food in the long, dry summer. Californian reports state that the trailing salt-bush, when chaffed, makes excellent silage. A mixture of peas, tares, beans or clover, with maize or the cereals, greatly increases the food value of the silage, and according to Canadian experiments one acre of sunflowers, with two of tick beans and four of maize, makes a very satisfactory balanced ration for the dairy cow.

Period of Maturity.

Silage should contain 75 to 80 per cent. of water; that is, most crops should be siloed when the flowers are all out and the grain well formed. An exception occurs in clover, trefoil and lucerne, which should be cut when in full bloom, and allowed to wilt one day before filling into the silo. Generally speaking, the crop is ready for the silo a little earlier than it is for hay. Maturity is very important in the case of maize and similar crops which mature rapidly after the cobs are well formed. Immature maize contains little nutriment, as will be seen from the following table[1]:—

COMPOSITION OF ONE ACRE OF MAIZE AT DIFFERENT PERIODS.

New York (Geneva) Station.

		Water. lbs.	Dry Matter. bs.
July 30 ..	Tassels, out ..	16,426 ..	1,619
August 21 ..	Kernels, milky ..	27,957 ..	4,643
September 7 ..	,, glazed ..	25,093 ..	7,202
September 23 ..	Crop ripe ..	20,542 ..	7,918

Stack Silage.

In conclusion, a word may be said about stack ensilage. It will be seen from the foregoing that I do not recommend it for general adoption, on account of the amount of waste due to the imperfect exclusion of the air. This is shown by the fact that stack silage has

[1] From Henry, *Feeds and Feeding*, p. 167.

always lost the peculiar aroma of chaffed silage, indicating the extent to which fermentation has progressed. In a year like the present, however, when everywhere there is abundance of fodder to hand, it is very much better to make a stack of some kind rather than be without succulent food in the dry weather. The main points about the stack are that it should be circular and as high as possible. Settlement will reduce the height by about one-half. The stack requires to be weighted, and this is best done by placing a thickness of two or three feet of earth on top of it. A convenient plan is to surround it with a circle of saplings to keep the walls upright, and to locate it under a tree with a suitable branch 25 feet from the ground A pulley can be attached to this, and used to hoist up the last of the fodder, and the earth to be placed on top of it. If the binder has been used to cut the crop, the bands should be cut and the sheaves spread out as the stack is being built.

THE MURRAY WATERS AGREEMENT.

The misunderstanding that has arisen regarding the nature and effects of the agreement entered into by the Premiers of New South Wales, Victoria and South Australia for the allocation of the waters of the Murray, makes it desirable to present to our readers the salient points of the explanation given by the State Premier, Mr. Irvine, to the deputation representing the Water Trusts which recently waited upon him in connection with this matter.

In dealing with the resolution :—

"That the Waterworks and Irrigation Trusts' Association, on behalf of water trusts throughout Victoria, most strongly protests against the allotment of the River Murray waters as proposed by the recent Conference of Premiers, as such arrangement, if ratified by Parliament, would be disastrous to the interests of the people of this State who are dependent upon the waters of the Murray and its tributaries, more particularly during the summer months."

the Premier said, that if there were any foundation for the statement in it, there would be very good grounds for asking Parliament not to ratify the agreement. If the agreement would have the effect of seriously curtailing the flow of the waters of the river, not merely in an ordinary year, or in an average low year, but in any year we have known, he would not be a party to it nor ask Parliament to ratify it.

The charge was that Victorian interests would be endangered during the five months period, February to June inclusive.

The Department of Water Supply had prepared a chart showing the gaugings of the Murray from 1884 to the present time, a period covering twenty summers, the figures for each month in each year being shown separately.

That chart showed the natural flow at the eastern boundary of South Australia, estimated from the Morgan gaugings. It also showed the flow as it should be, in each month, in order to enable the agreement to be complied with. The chart further showed that even during these extremely dry, these abnormal months of the late drought, the agreement as it now stood would enable all the water which was being taken away during that period of five months to be still taken away, without any storage whatever. Any allocation of water for irrigation must depend largely on storage. The actual amount of water pumped could not bear any comparison with what can be taken away by gravitation, as at the Goulburn Weir off-take. Large quantities, therefore, can only be taken away by having large storages. Suppose there were no water stored to fall back upon, we would be entitled to draw from the Goulburn and the Murray as much as has ever been drawn in those five months. The chart shows that there has been a terrible fall during the last few months. In ordinary years the flow goes up to—in the seven months—considerably over 1,000,000—1,500,000, or 2,000,000—cubic feet per minute. During the five months it has almost always maintained a flow (leaving out

these exceptionally dry months) of over 200,000 cubic feet. In April last the flow was 66,000 at the boundary. That is a little more than a quarter of the lowest of a typically low year. We ought to have had a natural flow of 305,000—we had only 66,000; therefore, each of the amounts to be taken by South Australia, New South Wales, and Victoria would, under this agreement, have to be reduced by the proportion of 305,000 to 66,000. Victoria's share would thus be reduced from 100,000 to 21,600 cubic feet per minute. That is extremely low, *but it was a great deal more than was drawn from all sources for Victoria for that month.* The actual amount taken from all sources in Victoria that month was 16,700 cubic feet per minute, including the total from the Goulburn, the Murray, and at Mildura. Then in March, where it approaches nearest, it comes to about 26,000 in each case. At all other times the amount divertible under the agreement has been vastly in excess of the amount actually diverted. Then, it must be borne in mind, that the question has been dealt with apart from storage altogether. Assuming that we have no storage at the Goulburn and Waranga (because we will not have it at Waranga for two years) yet under this agreement we would be able to take more water than was ever used during those extremely disastrous months this year.

In addition, the Premier said he would not be prepared to ask Parliament to sanction any agreement that would not be absolutely safe for the people of this country. He had taken up the position that, in recommending any agreement of this kind to Parliament at the present time, we ought to show that the water necessary for the actual uses, and now available for the various Trusts in Victoria, might be taken away without materially, or to any appreciable extent, trenching upon the water supply reserves in the Waranga Storage.

Under the close examination he had been able to give to the subject with the different experts and with the assistance of the very carefully-drawn chart, so far as he could see into a matter beset with complications, it seemed to him that the agreement was one that gave absolute security to all existing rights, and preserved all the right of drawing away any of the water that would be necessary during this dry period. The Waranga storage, when made, would, of course, be filled, not when the river was running at this abnormally low rate, but when there was a full river, and it would afford an abundant security against failure. It would make our position infinitely stronger than the figures indicate; but, on the other hand, it must not be forgotten that before it is made or completed we should have (if we get the necessary funds) to proceed with the formation of the channel westward and with the supply of water to the Trusts for which it was originally intended. He assured them that in anything like normal conditions there was no reason for concern at all, and that even under abnormal conditions there was no cause for apprehension.

In replying to questions, the Premier declared that it was absolutely incorrect to state that water would have to be let out of our storages to make up a flow of 150,000 cubic feet at the eastern boundary of South Australia.

SUMMER FODDERS FOR THE NORTH.

By H. Pye.

The year 1902 will in this State mark an epoch in regard to the growth of summer fodders. For many years their cultivation has been advocated by those interested in the farming community, and at the Dookie College they have been grown extensively for the last sixteen years. There is no doubt but that when they become better appreciated by farmers, they will never let a season pass by without making provision for them. I feel confident that as soon as this is firmly impressed on the minds of the farmers of the northern areas of the State especially, the value of their land will be much enhanced, owing to its greater stock-carrying capacity.

There is one thing certain, and that is, it is not possible to grow summer fodders without thoroughly preparing the land and treating the crop as a really important part of farm economy. It is only a speculation to sow the seed on the stubbles, or on poorly tilled land.

Summer fodders need all the attention that a first-class cereal crop does, if first-class returns are expected. In the dry districts of the State it cannot be expected that great crops will grow, but I believe it would be rarely that they did not much more than compensate for the labour of putting them in. In the more favoured parts of the country the tonnage of fodder grown on every well tilled acre would be a marvel to many who do not now grow it, were they to take the matter in hand and carry out the experiment. For sheep, the importance of summer fodders is freely recognised in many countries. For cattle, their use is also well recognised, and for such they are more known in this State. The better carrying capacity of the land for stock, owing to the decimation of our flocks and herds during the years of drought, must be brought more prominently before our eyes, and it will be conceded by practical men who thoroughly understand the use of summer fodders, that in them we have a splendid opportunity of making up leeway.

It may be asked, what are summer fodders? since in the cooler and more moist parts of the State many plants will thrive in summer, the seed of which has been sown in spring, that would be useless in the drier and warmer districts having a scant rainfall. The summer fodders dealt with in this paper will include maize, sorghums and allied plants—millets, legumes of special kinds, and certain other plants that will be named, but which are not generally grown.

Maize.

A number of varieties of maize were tried last season, and though it cannot be said that any of them were a success when we compare the crops with those grown on rich river flats, or in parts

where the rainfall is good, there is no doubt but that on well prepared land, where the seed is not sown too thickly, the results are quite satisfactory. Where the seed is sown thickly the plants are small, and so also are those grown in land that has been ploughed too late in the season, and contains little reserve of soil moisture.

Maize can only be considered at Dookie as a forage crop which plays its part before the sorghums are ready. It is a good plan to have a small area of it in the field in order to prepare the stock for the sorghum, which they do not relish at first; but, by confining them to it, it is not long before they begin to eat it and improve.

Maize, unlike sorghum, does not readily grow again after being once eaten down, though occasionally, when good rains have fallen, there are a few shoots thrust forth. Maize can be pastured at any time, and when grown for sheep it is not generally allowed to grow too tall, especially when there is a succession of fodders coming in, and the field may be utilised for other purposes. For cattle, it may be allowed to grow until the cobs are beginning to form, but here it is better to graze it down before the hot winds dry up most of the foliage as they frequently do. Calves appear to like and thrive on it, especially in conjunction with other food, in order to form a more balanced ration, while pigs, too, make good headway when grazing on it. The seed can be sown earlier than that of sorghum.

The following varieties were tried during 1902:—White Horse Tooth, White Cap, Sibley, Long Yellow 90-day, Klondyke, Ohio Gold Mine, Leaming, Red Flat, Cuzco, Mastodon.

From year to year a number of varieties of sugar maize have been grown, but the setting of the cobs has not been good; nor, in fact, is it good, as a rule, in regard to any of the varieties; but as it is only as a fodder that we need them, more attention is paid to the stalks than to the cobs.

In all the American agricultural papers there is mention of corn stover or maize stalks, from which the cobs have been picked. This is doubtless a useful stand-by for winter, and the sooner it is stacked after the cobs are picked the more nutritious it will be. In the irrigable areas, where the maize is grown for the cobs, this may be done, but in the drier parts this does not enter into our plans, as the plants never reach that stage if properly utilised.

This summer there has evidently been a good deal of maize grown successfully in the northern districts, judging from the correspondence received at the College concerning it, and in some cases there has been a surplus, no doubt owing in a great measure to the splendid rains of December last, and the utilisation of that surplus has evidently been a matter of consideration.

Sometimes maize is grown with other fodders, but in the dry North I do not think this advisable until we can find a more suitable plant to grow with it. It is too early for cow-peas, which are more suitably sown with the later maturing sorghum.

The land that was deeply ploughed in the late autumn, and kept in good order, naturally gave the best results, owing to the greater abundance of soil moisture present, and its freedom from weeds, although this season weeds were not very troublesome.

The drills were about 30 inches apart, which is much less than when growing maize for seed, and this allowed a certain amount of cultivation during the early stages of growth. In order to ensure the packing of soil around the seed, and a more regular germination, the roller, followed later on by the harrows, had the desired effect. If the drills were 3 feet apart, cultivation could have been kept up much longer with advantage to the growth of the crop, although it increases the cost of the crop; still, if summer fodder is needed for the stock, this must be done, or larger areas put in, which amounts to the same thing. Much depends on the size of the grain, and the general size of the plants, as to the rate of seeding. In the dry districts, a bushel of seed to the acre, sown 3 inches deep, would in most cases be ample, whereas in the moister districts, where the growth is rank, from 1½ to 2½ bushels would not be too much, especially for the grazing of sheep. A careful harrowing or two while the plants are young, say 6 inches high, has a good effect, and similar in some respects to the effects of harrowing wheat during its early growth. The harrows should be light, and the teeth slanting more or less backward in order that the fewest number of plants will be torn out, and the roots will not be cut; two inches deep for cultivation should be the limit.

When to feed the crop off, and how to feed it, will depend on the conditions under which the farmer may find himself placed. If he has a large area under the crop he will need to put in his cattle early. If the crop is not so large but that his stock can consume it before winter, then between the flowering and the ripening would be about the right time. If the area of crop is a small one, then it would be more economical to cut it. The silo should play a prominent part when there is likely to be a surplus, and if the farmer have no silo, then with the plough and scoop he may make a pit, and bury the fodder in it by means of the scoop, whilst the tramping of the horses will help to consolidate the mass. Trim the earth to throw off rain, and with a plough-furrow keep the pit drained from surface flows.

In the moister parts of the State, no doubt, rape, rye and a few other fodder plants may succeed when grown with it, and grazed down by the stock.

A little manure should be drilled in with the seed in order to give the young plants a good start. This is a very important matter, and it often is the means of keeping the plants alive during a dry period, waiting for the early autumn rains.

The Sorghums.

Of the summer fodders for the dry northern areas, the sorghums stand first among plants belonging to the grass family. They may

for agricultural convenience be divided into the saccharine and the non-saccharine varieties. Early amber cane and other varieties of amber cane form examples of the first-named division, while Dhoura, Kaffir corn, Jerusalem and Egyptian corn, which are coming more into favour as forage plants, are examples of the latter division. The percentage of sugar in these is small compared with that in amber cane, from which sugar and treacle may easily be obtained. The seeds of the sorghum are much smaller than those of maize, and do not germinate so freely. They are useful for poultry and pigs, and in many places the seeds are extensively used in making a kind of flour for porridge. It is only as a green forage, as ensilage, or hay, that the sorghums interest the farmers of the northern parts, particularly the first-named.

Although sorghum will thrive under less favourable conditions of soil and climate than maize, still it needs a well prepared seed bed and almost the same general treatment that is given to the maize crop. Drilling in the seed is better than broadcasting it, as the germination will be more regular. In the latter case a good deal is not covered sufficiently or may be covered too deeply. The young plants are delicate looking, but as soon as they become well-rooted and firmly established a harrowing will be beneficial, provided the seeding be not too thin. In order to get the best results, a few cultivations between the drills are needed, more particularly in the drier districts, but as a rule the crop, after being drilled in, is left to its own resources, though sometimes the harrows are run over the young plants.

The time to sow sorghums and maize is as soon as the soil is warm, which varies from the end of September to the end of November. After November the germination is irregular owing to the fewer showers, but in order to provide feed for sheep and cattle to graze on during the end of autumn, a succession of sowings may be carried out until the end of December, and even later, but there is not the same chance of success as with the earlier sown crop.

The amount of seed to sow to the acre varies according to the conditions of climate and soil. In moister climates thick sowings are more likely to suit, but in the hot dry districts the thinner sowings are much more satisfactory. From 12 to 24 inches between the drills where no after-cultivation is given, and the plants from 5 to 8 inches apart would be the limits that give the best general returns over a number of years. Unfortunately, especially with broom corn, the seeds sold are frequently immature or old, and do not germinate well, though sometimes the non-success is due to burying the seed too deep. Two inches below the surface should be the limit in most soils, and when the drills are 2 feet apart it will take from 4 to 6 lbs. of seed per acre in this district. The latter seeding would allow the use of the light harrows, with teeth deflected backwards, once just before the plantlets appeared, and again after they were established. In America the seeding is much heavier, and would go as high as two bushels to the acre when providing pasture for sheep in the more favoured districts, and diminishing to three-quarters of a bushel in

the drier districts. The seed is cheaper in that country than it is here. When all the coulters of the ordinary wheat seed drill are being used, it would take from 1 to 1½ lbs. of good seed per coulter per acre, which is rather much.

In some countries the stock are turned into sorghum when it is not more than 18 inches high. There is no doubt but that the stock do not like this fodder at first and must be encouraged to make a start on it, hence the value of a small area of maize to start on. There is still much room for experiment in regard to the feeding capabilities of this forage when young. When cut or eaten down it springs up afresh, and in that respect also is much more hardy than maize.

It has been repeatedly pointed out that stock should not be turned into sorghum when hungry, or when the system is charged with compact masses of dry feed. A little of the green fodder should be cut and given to the cows, and if chaffed or mixed with a little ordinary wheaten or oaten chaff, they will be more inclined to take to it. There are other ways in which the same object may be accomplished. This season there have been several instances where farmers have lost stock by not attending to the above.

Broom corn is one of the varieties of sorghum that has been developed owing to the use made of its seed panicle in the making of ordinary American brooms. It is a useful fodder plant also and has a light coloured foliage that stock like. It is early, and is useful on that account to grow some for an early bite for cattle. There are some objections to cattle and horses grazing on sorghum, as they trample down soil and otherwise waste a good deal of the crop, still where labour is scarce and dear this has to be put up with. Kaffir corn, Dhoura, Jerusalem, and Egyptian corn are varieties of non-saccharine sorghums having dense panicles of seed on short stalks. The seeds are somewhat ovate, and frequently slightly compressed laterally; they vary in colour from white to brown or partly of both colours. Parrots are a pest where these plants grow, and cause much loss of seed.

The principal saccharine or sugar producing sorghums grown are the varieties of amber cane, and these are much better known in Victoria than any of the others. Imphee, or Planters' Friend, is a late variety of sorghum. It does not grow as high as some, but is very leafy, and is more suitable for late autumn or early winter use.

Teosinte has a good reputation in some places, but it is an absolute failure here. It is sometimes classed as a sorghum of the non-saccharine division, and has been tried here for the last fifteen years without once growing 2 feet high.

Millets.

These are usually classified for agricultural purposes according to the shape of the seed panicle of certain well-known varieties. Thus the foxtail millets have for their type the well-known Hungarian millet.

The bulrush millets are represented by the Egyptian or Pearl millets, the close-panicled millets by the Barnyard millet, and the spreading panicled or broom corn millets by the White French millet.

The millets are very useful as catch crops, especially the Hungarian, although this season, owing to the seed of the latter being of low germinable quality, the results were not nearly as good as those from the White French millet, which produced an excellent crop for this district, and giving a return at the rate of three tons per acre, whilst the Red French millet gave just about one-fifth the yield. Several cuttings are obtained in more favoured climates, but rarely more than two are obtained here. The second is really only fit to graze off.

Millets, like sorghum and maize, thrive best in a nice free loamy soil with a fair amount of organic matter present. If the soil be warm and not too dry, millets will give satisfactory returns, even though the soil be not naturally free, yet it must be well worked. The roots when the plants are pulled up will be found mostly near the surface, and this should be well supplied with plant food.

As Hungarian and French millets grow quickly, successional sowings may be made from the time the ground is warm until the beginning of February, if the rains be propitious.

The seed bed should be well worked, and as the seed is small it should not be sown deeper than 1¼ inches for the larger seeds, and less for the smaller ones. It takes from 6 to 10 lbs. of the seed to sow an acre in the dry districts, and if the seed could be distributed evenly, even less would suffice. If the crop is to be harvested care must be taken not to wait too long. When the seed panicles are well formed and the seed is just about ripe it should be cut, or just before this period. It makes useful hay, and is better given to stock with a little oaten or wheaten hay, as it is somewhat laxative when green, and acts on the kidneys also, especially when cut in a riper stage.

The Egyptian and Pearl millet is a splendid fodder in districts where the soils and climate permit of its successful growth. It has only been a success here once in ten years, owing to the limited summer rainfall. The seed is small, but an enormous plant will spring from one seed when the surroundings are congenial. This fodder plant may be grazed, or cut for silage, and is well liked by stock, more so perhaps than most of the others. It should yield very heavy crops on the rich river flats, where I would not be surprised to hear of yields of over 50 tons to the acre, as several cuttings can be made, provided the heat and moisture be present. The young plants stool along the ground, and then shoot up to eight or ten feet high.

The Barnyard millet has not been grown much in Victoria. There are a number of varieties of it, most of which are coarse when compared with Hungarian millet. They did not succeed as well as the White French during the early part of autumn but developed considerably towards the end. The Japanese varieties are somewhat coarse, and bear much seed. The broom corn millets growing this season

have succeeded better than any of the others up to the present, especially the White French, which is laden with plump seed, that should prove very fattening to pigs grazing on it.

In general the White French millet would not be considered as useful as the Japanese and others, except for special purposes, such as for the rapidity with which it grows and ripens its seeds, and so quickly fills a gap whilst waiting for the other fodders to grow.

Lucerne.

The chief of the leguminous fodder plants is, without doubt, lucerne. None of the clovers will succeed here as well as it; and, in fact, are absolute failures as summer fodders. Lucerne cannot be claimed as a success at Dookie, although it succeeds better than many summer-growing plants. The dryness of the climate, the shallowness of the soil, and the deficiency of organic matter, do not lend themselves to successful lucerne growing. However, in many parts of the north, where the soil is more suitable, lucerne is a valuable summer fodder, and especially where irrigation is practised. It succeeds better here when cut, and not grazed, still the crop is not as payable as sorghum, although perennial, yet in conjunction with millet, it improves the flesh-forming capacity of the food, and enhances the ration.

Subsoiling where the land allows of it is a great advantage. The seed bed should be perfect, also free from weeds, and the seed should be sown in the autumn in this district, at the rate of from six to eight pounds per acre in drills.

Cow Pea.

A number of varieties have been tried this season, and in regard to the seed production the white variety with the black spot at the hilum is the most prolific, and much the earliest of those growing here. It does not produce as much fodder as some of the others, such as the Dun and Black varieties. In districts where maize and sorghum grow readily, cow peas sown along with them would improve the feeding value of the crop. Cow peas are not at first liked by stock, but when the plants begin to ripen they are eaten more readily. At Dookie the cow pea is at its best during March, especially when there have been good rains falling in February. The cow pea should not be sown until the soil is warm. From the beginning of October to the end of November is about the best time. The young plants will not make much headway here until after the New Year.

Soy Beans.

These do not withstand the drought like cow peas, but are more relished by stock as a fodder, either as green forage or hay. Where there are any rabbits it is difficult to grow them, as they are eaten off when they are young. This fodder should succeed anywhere where French beans thrive. As a vegetable the soy bean is much in demand

in some places. The seed may be sown after all fear of frosts is over, in drills sufficiently wide to permit of cultivation. The seed needed per acre depends on the size, as that of some varieties is much larger than others. About half a bushel to the acre should suffice, but in some places one bushel per acre is recommended. The price of soy beans will preclude their popular use as forage plants, even did the rainfall permit of their general success. The soil should be deep, good, and well worked before, and once after the seed is sown. If broadcasted the light harrows may be used, provided the teeth be regulated not to tear up the seeds just about to germinate. If the sowing be a thick one, the harrows when passed over the crop would no doubt improve it, but this applies more where the soil is not too dry, and the plants can readily freshen up again.

We have growing naturally a few related species of the genus to which this plant belongs with which I hope to carry out some experiments. These are very hardy, and grow in very dry situations. They are, however, small, and not so succulent as the cultivated varieties, yet by cross fertilisation some important results may be achieved.

Other Crops.

A number of species and varieties of plants belonging to the genus Phaseolus were tried. Although they seeded, still their prolificness was such that it would not warrant the growing of these plants on more than a small experimental scale. Certainly, in moister districts that are also free from frosts, these may thrive like French beans *(Phaseolus vulgaris)*, which belongs to the same genus. The following were experimented with:—Mung *(P. mungo)*, Urd *(P. radiatus)*, Moth *(P. aconitifolius)*.

Among the other leguminous plants experimented with this season were a number of varieties of garden peas, field peas, Spanish pea or lentil, sugar pea, hairy or sand vetch, common vetch, golden vetch, and others. Owing to the excessive dryness none of them could be said to be a success. The same may be said of the clovers, of which all varieties procurable were grown in the experimental plots.

The milk vetch *(Astragalus falcatus)*, lately imported from France, had a very trying season for its trial, and did not succeed in establishing itself.

Sour Clover *(Melilotus indica)*, sent by the Government Pathologist for trial, grew about 6 inches high. It seeded well, and then died off. It is not unlike Bokara Clover, and is recommended as a green manure. It succeeded best of the clovers during 1902, and this season the plants have reached about four feet high and are still growing.

HOW TO FORETELL FROSTS.

By G. H. Adcock, F.L.S.

During the present winter there have been numerous enquiries regarding the means of foretelling frosts, and thus being prepared to avert the injury attributable to this cause. It has, therefore, been deemed advisable to give a short account of the method in the *Journal of Agriculture*, and to furnish a Dew-point Table, so that by being prepared, vignerons and others may be able to save themselves the serious losses of which frosts have so often been the cause.

In the *Journal of Agriculture*, volume i., page 877, Mr. Dubois gave concise instructions for the procedure to protect the young, tender shoots of vines and other plants (such as potatoes, etc), from injury, by raising a pall of smoke over the vineyard before sunrise, and thus preventing the too rapid thaw, which is often so fatal to tender growth. This method of protecting the vineyard is, I believe, thoroughly understood; and is, as a matter of fact, widely practised throughout this State. Many vignerons, from actual experience, can testify to the benefit of this plan.

But the difficulty has always been to know, with anything like certainty, when it would be necessary to light these fires.

The Jules Richard Frost-registering Thermometer, described by Mr. Dubois in the article just quoted, gives warning by means of an electric bell, which rings when the temperature falls to a certain point to which the instrument may be set. The manager is roused by the alarm, and loses no time in calling sufficient assistance to light the fires, and thus protect the young shoots with smoke.

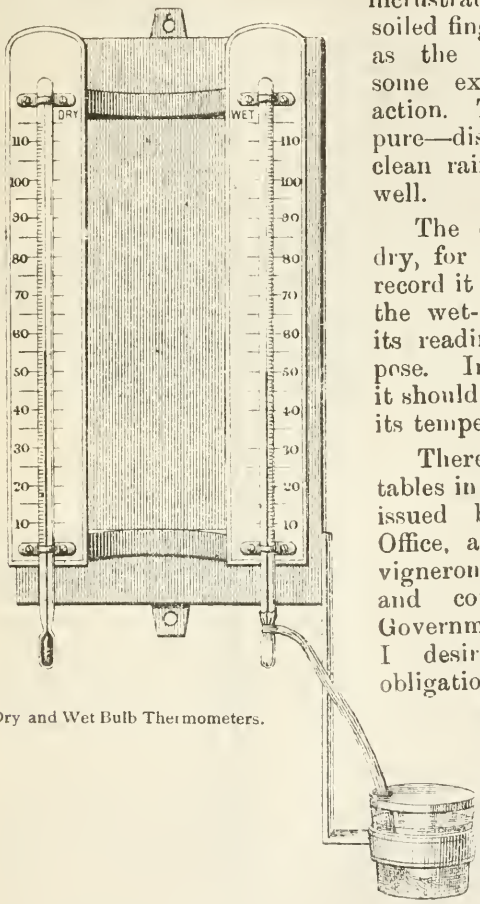
This instrument has been used in Victoria, and I venture to predict will be more extensively adopted when it becomes better known.

The method of predicting frost by means of the dry and wet bulb thermometric readings and a dew-point table is by no means new, and has been adopted with great success in many parts. Mr. F. de Castella, of Château Dookie, may fairly claim to be the pioneer of this system in Victoria.

The thermometers used for the purpose should be reliable and identical instruments, provided with small bulbs, and fixed at least 4 inches apart. They should not be placed where their temperature is raised by radiation of heat from buildings, etc.

The wet bulb, as the name indicates, is kept moist. This is usually managed by putting round it a piece of some *thin* fabric, such as muslin. A strip of this material, or some attached threads, communicate with water in a vessel provided for the purpose. The covering of the wet bulb is kept constantly moist by capillary

attraction. The muslin, or material used, should be free from all foreign matter, such as any mineral salts that may be used in its manufacture, and also starch. It is, therefore, wise to have it well washed before using. The fabric should also be often washed or renewed, otherwise dust particles are apt to accumulate and form an incrustration. Touching it with soiled fingers should also be avoided, as the perspiration interferes to some extent with the capillary action. The water used should be pure—distilled, if possible—but clean rain water will answer very well.



Dry and Wet Bulb Thermometers.

The dry-bulb must be actually dry, for if it becomes damp, the record it gives is too near that of the wet-bulb instrument to render its readings of value for our purpose. In moist weather, therefore, it should be carefully dried before its temperature is taken.

There are several dew-point tables in existence. I have used one issued by the Washington War Office, and adopted by Californian vignerons. Through the kindness and courtesy of Mr. Baracchi, Government Astronomer, to whom I desire to acknowledge my obligations, I am enabled to reproduce the dew-point table of the Royal Meteorological Society. This is uniformly adopted in all British observatories. The various tables differ slightly, and it must be understood that the values are approximate only. But the work of foretelling frosts is of sufficient importance, and the trifling trouble incurred by the observer has been amply compensated by the value of the crop saved by being forewarned.

Dew, as the merest tyro knows, is formed on calm, clear nights only. If the sky becomes overcast with clouds they prevent the radiation of heat into space, and the air is not cooled sufficiently for the deposition of dew. The prevalence of wind keeps constantly renewing the various strata of the atmosphere, and the air in motion near the earth's surface prevents cooling to the dew-point temperature. The dew-point temperature is that temperature at which dew is

TABLE FOR CALCULATING THE DEW-POINT TEMPERATURE.

Dry Bulb Temperature.	Difference between the Readings of Dry and Wet Bulb Thermometers.														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
	Amount to be Subtracted from the Wet Bulb Reading to obtain the Dew-Point														
30°	3·2°	6·3°	9·5°	12·6°	15·8°	18·9°	22·1°	25·2°	28·4°	31·5°					
31	2·7	5·4	8·1	10·8	13·5	16·2	18·9	21·6	24·3	27·0					
32	2·3	4·6	7·0	9·3	11·6	13·9	16·2	18·6	20·9	23·2					
33	2·0	4·0	6·0	8·0	10·0	12·1	14·1	16·1	18·1	20·1					
34	1·8	3·5	5·3	7·1	8·9	10·6	12·4	14·2	15·9	17·7					
35	1·6	3·2	4·8	6·4	8·0	9·6	11·2	12·8	14·4	16·0					
36	1·5	3·0	4·5	6·0	7·5	9·1	10·5	12·0	13·5	15·0					
37	1·4	2·8	4·3	5·7	7·1	8·5	9·9	11·4	12·8	14·2					
38	1·4	2·7	4·1	5·4	6·8	8·2	9·5	10·9	12·2	13·6					
39	1·3	2·6	4·0	5·3	6·6	7·9	9·2	10·6	11·9	13·2					
40	1·3	2·6	3·9	5·2	6·5	7·7	9·0	10·3	11·6	12·9					
41	1·3	2·5	3·8	5·0	6·3	7·6	8·8	10·1	11·3	12·6					
42	1·2	2·5	3·7	4·9	6·2	7·4	8·6	9·8	11·1	12·3					
43	1·2	2·4	3·6	4·8	6·0	7·2	8·4	9·6	10·8	12·0					
44	1·2	2·4	3·5	4·7	5·9	7·1	8·3	9·4	10·6	11·8					
45	1·2	2·3	3·5	4·6	5·8	7·0	8·1	9·3	10·4	11·6					
46	1·1	2·3	3·4	4·6	5·7	6·8	8·0	9·1	10·3	11·4					
47	1·1	2·2	3·4	4·5	5·6	6·7	7·8	9·0	10·1	11·2					
48	1·1	2·2	3·3	4·4	5·5	6·6	7·7	8·8	9·9	11·0					
49	1·1	2·2	3·2	4·3	5·4	6·5	7·6	8·6	9·7	10·8					
50	1·1	2·1	3·2	4·2	5·3	6·4	7·4	8·5	9·5	10·6	11·7°	12·7°	13·8°	14·8°	15·9°
51	1·0	2·1	3·1	4·2	5·2	6·2	7·3	8·3	9·4	10·4	11·4	12·5	13·5	14·6	15·6
52	1·0	2·0	3·1	4·1	5·1	6·1	7·1	8·2	9·2	10·2	11·2	12·2	13·3	14·3	15·3
53	1·0	2·0	3·0	4·0	5·0	6·0	7·0	8·0	9·0	10·0	11·0	12·0	13·0	14·0	15·0
54	1·0	2·0	2·9	3·9	4·9	5·9	6·9	7·8	8·8	9·8	10·8	11·8	12·7	13·7	14·7
55	1·0	1·9	2·9	3·8	4·8	5·8	6·7	7·7	8·6	9·6	10·6	11·5	12·5	13·4	14·4
56	0·9	1·9	2·8	3·8	4·7	5·6	6·6	7·5	8·5	9·4	10·3	11·3	12·2	13·2	14·1
57	0·9	1·8	2·8	3·7	4·6	5·5	6·4	7·4	8·3	9·2	10·1	11·0	12·0	12·9	13·8
58	0·9	1·8	2·7	3·6	4·5	5·4	6·3	7·2	8·1	9·0	9·9	10·8	11·7	12·6	13·5
59	0·9	1·8	2·7	3·6	4·5	5·3	6·2	7·1	8·0	8·9	9·8	10·7	11·6	12·5	13·4
60	0·9	1·8	2·6	3·5	4·4	5·3	6·2	7·0	7·9	8·8	9·7	10·6	11·4	12·3	13·2
61	0·9	1·7	2·6	3·5	4·4	5·2	6·1	7·0	7·8	8·7	9·6	10·4	11·3	12·2	13·1
62	0·9	1·7	2·6	3·4	4·3	5·2	6·0	6·9	7·7	8·6	9·5	10·3	11·2	12·0	12·9
63	0·9	1·7	2·6	3·4	4·3	5·1	6·0	6·8	7·7	8·5	9·4	10·2	11·1	11·9	12·8
64	0·8	1·7	2·5	3·3	4·2	5·0	5·8	6·6	7·5	8·3	9·1	10·0	10·8	11·6	12·5
65	0·8	1·6	2·5	3·3	4·1	4·9	5·7	6·6	7·4	8·2	9·0	9·8	10·7	11·5	12·3
66	0·8	1·6	2·4	3·2	4·1	4·9	5·7	6·5	7·3	8·1	8·9	9·7	10·5	11·3	12·2
67	0·8	1·6	2·4	3·2	4·0	4·8	5·6	6·4	7·2	8·0	8·8	9·6	10·4	11·2	12·0
68	0·8	1·6	2·4	3·2	4·0	4·7	5·5	6·3	7·1	7·9	8·7	9·5	10·3	11·1	11·9
69	0·8	1·6	2·3	3·1	3·9	4·7	5·5	6·2	7·0	7·8	8·6	9·4	10·1	10·9	11·7
70	0·8	1·5	2·3	3·1	3·9	4·6	5·4	6·2	6·9	7·7	8·5	9·2	10·0	10·8	11·6
71	0·8	1·5	2·3	3·0	3·8	4·6	5·3	6·1	6·8	7·6	8·4	9·1	9·9	10·6	11·4
72	0·8	1·5	2·3	3·0	3·8	4·5	5·3	6·0	6·8	7·5	8·3	9·0	9·8	10·5	11·3
73	0·7	1·5	2·2	3·0	3·7	4·4	5·2	5·9	6·7	7·4	8·1	8·9	9·6	10·4	11·1
74	0·7	1·5	2·2	2·9	3·7	4·4	5·1	5·8	6·6	7·3	8·0	8·8	9·5	10·2	11·0
75	0·7	1·4	2·2	2·9	3·6	4·3	5·0	5·8	6·5	7·2	7·9	8·6	9·4	10·1	10·8
76	0·7	1·4	2·1	2·8	3·6	4·3	5·0	5·7	6·4	7·1	7·8	8·5	9·2	9·9	10·7
77	0·7	1·4	2·1	2·8	3·5	4·2	4·9	5·6	6·3	7·0	7·7	8·4	9·1	9·8	10·5
78	0·7	1·4	2·1	2·8	3·5	4·1	4·8	5·5	6·2	6·9	7·6	8·3	9·0	9·7	10·4
79	0·7	1·4	2·1	2·8	3·5	4·1	4·8	5·5	6·2	6·9	7·6	8·3	9·0	9·7	10·4
80	0·7	1·4	2·0	2·7	3·4	4·1	4·8	5·4	6·1	6·8	7·5	8·2	8·8	9·5	10·2

deposited, and when this is about or below 32° F., *i.e.*, freezing-point, a frost may be expected unless winds arise or clouds form to prevent it.

The readings of the dry and wet-bulb thermometers are taken during the afternoon, most particularly, however, about sunset. By taking a series of earlier readings we can ascertain whether the tendency to freeze is increasing or not.

To explain the method of working, let us suppose the dry-bulb temperature is 40° F., and that of the wet-bulb, 35° F., consequently the difference between the readings is 5°.

We take the vertical column 40°, and the horizontal line 5°. By following the figures opposite and below these respectively, we find the figures 6·5° given as the amount to be subtracted from the wet-bulb reading to obtain the dew-point. From the 35° record we deduct 6·5°, and get 28·5°, which is the dew-point required. As this is below freezing point (32° F.), a frost may be anticipated, unless, as already explained, clouds form or winds arise to prevent it.

ANTHRAX.

By J. R. Weir.

(A Paper read before the Butter Factory Managers' Association.)

Introductory.

The paper I am about to read on Anthrax and its history has been compiled (backed up by our official experience) from the works of the leading authorities of the world on the subject. Though there is still much to learn in connection with this disease, fortunately bacteriological science has advanced sufficiently to enable a correct diagnosis to be made, and there is no occasion now for owners to be put to any unnecessary expense in eradicating disease erroneously pronounced anthrax, as was often done in former years.

As the object of our branch is to keep disease down and to keep the reputation of the State up, and at the same time cause as little loss as possible to the owner who is unfortunate enough to have an outbreak of disease, we get our work done thoroughly, but quietly, and we do not publish any more than we can possibly help, as to do such would only be to injure the owner, and scare the public.

As an instance, I may state that after the newspaper reports appeared of a recent outbreak, the Italian Consul refused to issue the necessary certificate for the introduction into his country of wool and other products from this State, but I am glad to say he afterwards changed his mind when I convinced him the outbreak was only a local one, and that our flocks and herds generally were amongst the soundest in the world.

Through this, very little is known by the general public of the valuable work done, or the losses saved the community by the Stock branch.

History of the Disease.

Briefly reviewing the antiquity of this dread disease, a reliable authority informs us that the sixth plague of Egypt, spoken of in the Second Book of Moses, was anthrax. This same writer further alludes to its transmissibility to man by clothing. Homer, in the Iliad, describes its ravages among men, mules, and dogs. Latin writers from Ovid to Virgil, including Plutarch, Livy, and Lucretius, make mention of the havoc caused by it among cattle, both in pasture and in sheds, sacrificial animals, and men.

In the years 1552, 1598, and 1599, several outbreaks occurred in Italy; and the Senate of Venice forbade the sale of beef under the penalty of death.

Kirchener in 1617 describes this bovine disease infecting mankind, and causing the death of 60,000 people in Europe. From that period to the present day outbreaks have been prevalent in various places

throughout the world, affecting not only all domestic animals, horses, donkeys, cattle, sheep, pigs, deer, dogs, fowls, but even fish and men.

In the year 1847 it made its first appearance in Australia in the county of Cumberland, in New South Wales, for which reason it was for a considerable time known in Australia as "Cumberland Disease," since when it has spread over the greater portion of Australia where stock are kept, and outbreaks have also occurred in Tasmania and New Zealand; in fact, it is well scattered throughout the world.

Definition of Disease.

Anthrax is an infectious disease caused by the ingress into the system of the spores or reproductive bodies of the *Bacillus anthracis.* It is not very probable that the bacilli and spores of anthrax ever pass directly from one animal to another; transmission is effected by intermediate bearers, such as utensils, people, and food. The major portion of the cases of infection by anthrax are caused by miasmatic infection of the soil. The means of immigration are three-fold, viz. —(1) by the alimentary canal; (2) by the skin and natural openings of the body; and (3) by the lungs. Cattle generally contract the disease through the alimentary canal, as also do dogs, pigs, and cats, while in horses and sheep it occurs through the skin.

Infection by the Intestines.

This is the usual form: the spores and bacilli gain access either through the food or drinking water, the chief port of infection being the small intestine, the mucous membrane of which need not necessarily be injured.

Though the gastric juice, as in some other diseases, may kill the bacilli, yet the spores are unaffected by it. Vehicles for the transmission of the spores in this form are to be found in food stuffs grown on, or near, places in which animals after dying of anthrax were buried insufficiently deep, or where excrements are cast, and fodder obtained from infected districts.

In the Geelong district during the past year each of the isolated cases of anthrax have been traced directly to the bone-meal given to the cattle to make up for deficiencies in the soil. In some cases the mortality began after the bone-meal had been used for some time. When its use was stopped the deaths ceased, and when again used the cattle died. In one instance in a small paddock upon which bone-meal had been used as manure, deaths occurred among cattle while grazing on the land, ceasing when they were removed to another pasture, and when brought back to this paddock again there were more deaths. That bone-meal was the medium through which the disease was contracted was proved by Dr. Bull, Demonstrator of Bacteriology at the Melbourne University, who, by a series of experiments on guinea-pigs with cultures from the bone-meal submitted to him, caused the deaths of the subjects operated on in periods extending to forty-five hours from the time of inoculation, *post mortem*

examinations showing all the clinical appearances of anthrax, and microscopic examination of blood from the organs verifying the diagnosis.

In the case of food stuffs from a locality where anthrax has prevailed, the spores contained in the soil may attach themselves to the plant, or plants, or some of the infected soil may adhere to them, as in the case of root crops such as turnips and potatoes. Again, water receiving the drainage from high lands which have been affected with anthrax, may cause an outbreak miles away from the primarily affected spot; or water receiving the drainage from fellmongeries treating wool from sheep which have died from anthrax.

Pasteur's theory that the spores were brought to the surface by earth worms, and hence diffused by this means, though considered untenable by Koch, has been supported by experiments showing that 5 per cent. of the earth worms from an anthrax pasture sent to him were found to contain the contagium of anthrax. Other experimenters have proved that anthrax spores may be disseminated by slugs and insects.

Infection by the Skin.

In Corowa district (New South Wales) cases have occurred of men becoming infected through the bite of a fly, as the spore was transmitted by this means.

On untanned skins and hides from infected animals, the larvæ of the skin worm excrete the spores in their fæces, and the hides, being moved about, become vehicles for the diffusion of disease.

Infection by the skin is not so common as in the preceding instance, and is alluded to as "Carbuncle." In such cases the bacilli gain entrance through wounds on the skin, or mucous membrane of the mouth, anus, or vulva, while the animals are grazing, infected utensils, dog bites, bleeding with instruments used on infected animals in operations, such as castration, or the opening of abscesses and tumours.

Bollinger produced anthrax in rabbits by inoculating them with flies which had been caught on the carcase of a beast that had died from anthrax, and Machreoff records experiments showing anthrax has been produced in guinea-pigs by rubbing their skins with anthrax cultures, as showing the vitality of the spores; whilst Friedberger states they are even present on tanned skins.

Infection by Inhalation.

By this form of infection the spores penetrate through the lungs into the body, and although the rarest form of infection, Feser and other authorities have demonstrated by experiment that healthy organs of breathing can be infected in this manner.

It may even be possible that the disease can be transmitted from the mother to the fœtus. Latis, as the result of fifteen experiments on guinea-pigs, succeeded in transmitting anthrax to the fœtus in eight cases.

Occurrence of Anthrax.

While anthrax attacks all herb-eating animals, horses, cattle, sheep, goats, deer, camels, guinea-pigs, and mice are the most susceptible. Frohner asserts that a single bacillus introduced into the subcutaneous connective tissue suffices to kill guinea-pigs and mice. Cats, hares, and rabbits come next in order of susceptibility. Dogs, pigs, and foxes are not so susceptible, although many cases in pigs supposed to have been anthrax have been proven to be erysipelas (Friedberger). One attack confers in some animals an immunity to a certain extent.

Anthrax may occur sporadically, *i.e.*, only one or but few animals will be attacked: enzootically, *i.e.*, the disease attacks cattle or other animals in large numbers at the same time and place.

But most frequently it is sporadic; to a great extent its occurrence is dependent on certain conditions of soil, vegetation, humidity, and temperature, preferring black, loose, warm earth; mould, chalk, marl, and clay; soils containing much waste organic matter, such as river flats, boggy, swampy, or brittle land; also stable manure, a well-marked connection existing between the disease, and the amount of moisture in the soil. It is favoured by changes in the moisture of the soil, developing best on moist, swampy, boggy land, having an impermeable sub-soil, which has partly dried up after long summer heat. Wald and other observers have noticed an increase in the number of cases of anthrax as the moisture decreases in the soil. This also applies to dry mould, which becomes specially suitable for the development of bacilli when following heavy rainfall, thunder-storms, or floods, great heat with decrease of moisture sets in. Thus it is, that the development of bacilli being favoured by heat, anthrax is more prevalent during late spring, summer, and early autumn months, while as cold checks the growth of these germs, cases occurring in stock during cold weather have been contracted through the medium of food or water supply.

In passing, it is well to note the temperatures which are favourable to the development of the spores and bacilli, as also those which are fatal. The most favourable temperature for development is 95° F., but it is arrested at 113° F., and killed under a prolonged heat of 131° F., but they can withstand cold provided it is not below 14° F., for three days; sunlight also impedes their development.

Post Mortem Appearance of Carcase.

The carcase is much swollen, the limbs projecting. From mouth and nostrils, as also from the anus, there escapes, in the case of the mouth and nostrils especially, a considerable quantity of serous effusion, resembling blood and water mixed, and whisked rapidly into froth, which, when the latter has subsided, evinces no disposition to coagulate; the skin round the anus and vulva often burst, or in the case of bullocks the scrotum.

On pressure of the carcase by the foot a peculiar crackling, whirring noise is heard, and the odour from the carcase when the

beast has only just died is of a heavy nature. Decomposition sets in very rapidly, owing to the bursting of the blood vessels, and the tar-like colour of the blood which escapes from the hinder openings of the body is especially to be noted.

Should an owner desire to pursue his examinations further, by opening up an animal in order to discover the change under the skin, and how the internal organs are affected, it would be wise for him to have an abundant supply of disinfectant, such as corrosive sublimate, of the strength of 1 in 500 in water, or carbolic acid, 5 per cent. solution in water. He should also be most careful that no abrasions or cuts are on the hands. On dissection and opening back the skin, the blood vessels on the hide appear to be densely filled with black coloured blood, gelatinous infiltrations occur under the skin on the neck, and along the trachea down to the chest.

The flesh on the legs may vary in colour, from a dark brownish red to violet, infiltrated with blood spots. On further opening up the carcase the cavities of the body, abdomen, thorax, and heart sac will be found to contain varying quantities of fœtid fluid; blood is found to have escaped in more or less quantities under the serous membranes and heart sac, as also most particularly in the mesentery and the duplicature of the pleura (mediastinum). The neighbourhood of the kidneys is gelatinously infiltrated.

The internal organs, spleen, liver, kidneys, and lungs, contain a large quantity of blood. All the larger veins and the heart are filled with blood, and the surrounding tissues with fœtid fluid.

The spleen is considerably enlarged, often to five times its normal size; the pulp soft, more or less fluid, and stained a very deep red colour, almost black.

The liver, like the kidneys, is highly congested, and on dissection blood centres are visible, often with degeneration and inflammation of both liver and kidneys. Often in all the stomach pouches and compartments gelatinous and unhealthy infiltrations occur.

The lungs are greatly congested, filled with effusion—that is, like froth and water, and show spots as though blood was concealed beneath. The mucous membrane of the windpipe is much reddened, and shows similar blood spots to those spoken of as occurring in the lungs, in addition to which a considerable quantity of effusion will be found in the windpipe.

The blood, as before noted, is dark, and almost black, and of a very tarry lustre, showing no sign of coagulation, nor will it assume its natural red colour when exposed to the air.

It cannot be too strongly impressed on stock owners that in the form in which anthrax occurs in cattle in Australia, many of the evidences before quoted may be absent, but in every case the blood may be regarded as sufficiently diagnostic, and carcases which present the signs quoted, should invariably be regarded with suspicion, and destroyed by fire without removal from the spot where the death took place.

Destruction of Carcase.

In reference to this, I cannot do better than quote the opinion of the distinguished Professor Cruickshank, whose name is sufficient guarantee for an opinion on any matter pertaining to bacteriology. He says: "The surest method to render harmless all the bacilli which exist in the carcase is burning, but cremation offers practical difficulties, especially if several carcases have to be destroyed;" or, we may add, in the summer, in very many of our pastures. In cases where it is impracticable to burn, the natural openings should be plugged, and the body treated with quick lime, and afterwards buried.

If the carcase is buried, every care must be taken that it is not interred in marshy land, as the spores might find their way to the surface. Should the surroundings not be favourable to cremation, it is requisite that the pit should be of such depth that there should be not less than six clear feet of earth over the carcase, which should previously be covered with quick lime. Experiments have determined that with carcases so buried the danger of propagating the disease is minimised, if not absolutely prevented. It would be as well that the pit should be deep, and large enough to contain the scrapings from around where the animal died, to a depth of three or four inches; this, before removal, should be disinfected with quick lime, or strong carbolic acid, and the place from where the earth was removed left covered with quick lime, and the site of the burial fenced in for at least six months.

If death has occurred in a shed, the carcase should be removed for burial after adopting the precautions mentioned; any fodder or litter with which the animal came in contact should be destroyed, and the sheds and carts, after removing the carcase, or any posts, should be disinfected with strong lime wash, which should be prepared immediately before it is required—to each gallon of lime wash add 4 ounces of chloride of lime, or half a pint of commercial carbolic acid.

If the animal has died near a spring or stream, it should at once be carted away, not drawn along the ground, and the spot for a distance of several feet first sown with quick lime, hoed or dug up, and more lime heavily dressed over the surface, the area thus treated to be fenced in, to prevent stock feeding on it.

Danger of Animals Feeding on Carcase.

Apart from the risk which is imminent to persons cutting up the carcase of an animal which has died from anthrax, through becoming inoculated from it, there is also positive danger should pigs or dogs be fed with the meat.

On this subject Professor Williams, quoted by Cruickshank, says:—"The flesh of animals which have died, or have been killed whilst suffering from the disease, should not be used as food, either for men, pigs, or dogs, as it is apt to cause blood poisoning." And

Steele adds: "Pigs, dogs and poultry should not be allowed to feed on blood, flesh, and ejecta of anthrax victims." Cruickshank, by experiment, produced anthrax in swine by feeding them with anthrax offal, and the anthrax bacillus was isolated from swine in which the disease was accidentally induced on a farm, and the disease reproduced by inoculation of guinea-pigs and mice with blood from the spleen.

Precautions to be Observed.

In dealing with the products of infected herds, the Board of Health has recommended that the milk should not be used until after thorough boiling (then only on the farm) for a period of 14 days after the last case has succumbed or recovered; or for a period of 10 days after the cows have been isolated in a clean, disconnected enclosure from all infected animals or suspects; or for a period of 10 days after disinfection of all houses, floors, bedding, yards, paddocks, foodstuffs, utensils, clothing, or other material with which any infected animal may have been in contact.

Difference Between Anthrax and Some Other Diseases.

Poisoning.—Owing to the rapidity with which very many of the poisons cause death, it is quite possible for their action to be mistaken for anthrax; but with this latter it is rarely that the animal shows any sign of a struggle prior to death; while, with the former, there are very often manifestations of such being the case, and the exudation from the mouth and nostrils in the case of poisoning is but rarely tinted with blood, whereas, as previously mentioned with anthrax it is blood-tinted, and the rectum shows rupture. In cases of gastro-intestinal inflammation, in which paralysis has first occurred, death may occur without evidence of any struggle; but the non-coagulation of the blood as mentioned previously, is sufficiently diagnostic of anthrax. This remark applies also to the differential diagnosis of quarter evil or blackleg.

Treatment and Prevention.

We may safely assume that treatment is hopeless, as in the form prevalent in Australia, animals are stricken down so suddenly that owners have no evidence of the animals being sick until they are dead. In Europe, Touissant was the first to make use of protective inoculation. Since then Pasteur, in different countries and in Australia, also Messrs. McGarvie, Smith and Gunn, of Sydney, have vaccinated large numbers of sheep and cattle in New South Wales and this State with success. Therefore, vaccination appears to be the only method which stock owners have at their disposal to combat this scourge, and it would be to the interests of owners to adopt this course, and safeguard this great source of national revenue.

Conclusion.

I feel I have trespassed on your patience sufficiently long, but before concluding I wish to direct your attention to the magnificent

work done by Dr. Bull, Demonstrator of Bacteriology at the Melbourne University. During the past fifteen months some forty-five cases were submitted to him by our Department in various forms for bacteriological examination. These embraced post-mortem specimens and bone meal (Indian), and I am happy to state that many of the cases submitted to him proved not to be anthrax. The result he achieved in tracing an outbreak to be anthrax, and the source from which it sprang, viz., Indian bone meal, has led to the prevention of its dissemination through this medium by an Order-in-Council having been obtained prohibiting the importation of Indian bones or meal, unless for the purpose of being converted into superphosphates. Many of the other States of the Commonwealth have since passed a similar regulation, and I am in receipt of a communication from the Stock Department of New Zealand, expressing their appreciation on being apprized of Dr. Bull's research.

By the promptitude with which this gentleman dealt with the various items sent to him, the fears of stock owners were allayed, or if the necessity arose, immediate measures could be taken to prevent the spread of the disease on receipt of his report, as many obscure cases presented themselves which were impossible to work out unless by bacteriological examination by a specialist having at his command all the equipments of a laboratory designed for this form of scientific work.

SPRAYING FOR BLACK SPOT OF THE APPLE.

By D. McAlpine.

In the annual report given in the September *Journal* the general scope of these experiments was noted, and such results recorded as were likely to be of service at the spraying season. The earliest opportunity is taken to render a detailed account of the experimental work carried out during the season 1902–03, in the endeavour to improve our methods, and to test some of the particular mixtures on a large scale.

There were two special sets of experiments conducted—the one principally to see how far certain additions to the Bordeaux mixture rendered it more effective, and the other to test certain mixtures on a commercial scale, as well as arranging a plant for conveniently spraying a large orchard. The one set of experiments was carried out at Mr. A. F. Thiele's orchard, Doncaster, and the other, together with corroborative experiments to those at Doncaster, at Mr. D. Syme's Killara.

I.—Doncaster Experiments.

Spraying for black spot and other fungus diseases has now become such a recognised practice in the best orchards, that it is no longer a question of spraying, but rather of the best form in which to use the Bordeaux mixture, and the best means of applying it. Orchardists are constantly asking me if the addition of this or that ingredient will improve the mixture, and the only definite way in which to obtain an answer to the question is to try the various modified mixtures experimentally in the orchard for several seasons.

Mr. Thiele, who deservedly obtained the *Leader* prize for the best kept orchard of the Doncaster district, again kindly placed both his orchard and his services at my disposal.

The variety of apple chosen for experiment was Yates, on account of its well-known susceptibility to black spot, and there were nine sprayed plots, and one check of two trees each. A reproduction of this apple by the three color process accompanies this article. On account of the labour and time involved in checking results, only a limited number of trees can be used. Only one spraying was given on 1st October, just as the blossom-buds had spread out and were showing colour at the tips. The nature and results of the experiments are shown in the following table:—

3-colour process. R. S. Brain, Govt. Printer.

YATE'S APPLE.

TABLE I.—RESULTS OF SPRAYING AT DONCASTER.

Plot.	Treatment.	Yield in lbs.			Per cent. absolutely clean.
		Absolutely Clean.	Spotted.	Total.	
1	†Bordeaux 6· 4· 50	206	22	228	90·4
2	Bordeaux + 1 lb. Sulphate of Ammonia	266	35	301	89
3	Bordeaux + 1 lb. Nitrate of Soda	426	129	555	77
4	Bordeaux + 1 lb. Nitrate of Potash (Saltpetre) ..	394	91	485	81
5	Bordeaux + 1 lb. Sal-ammoniac	278	35	313	89
6	Not Sprayed	17	161	178	10
7	Bordeaux + 1 lb. Salt ..	210	22	232	90·6
8	Bordeaux + ¼ lb. Paris green ..	304	64	368	83
9	Bordeaux + 1 oz. Bichromate of Potash	61	12	73	84
10	Copper-Soda 6· 9· 50 ..	208	35	243	86

† NOTE.—All Bordeaux mixtures in Doncaster experiments made on the 6· 4· 50 formula.

From the forgoing table it will be seen that while the unsprayed plot gave only 10 per cent. of absolutely clean fruit, the worst of the sprayed plots, that is Bordeaux with nitrate of soda, returned 77 per cent., and with the latter the total yield was more than three times as great as that from the unsprayed plot. The cleanest fruit was from the Bordeaux and salt plot, 90·6 per cent. absolutely free from spot, followed closely by Bordeaux alone, 90·4 per cent. Bordeaux, with Paris Green, was distinctly inferior to Bordeaux alone, as only 83 per cent. was quite clean, and as these results were corroborated at Killara, it would seem that Paris Green reduces the efficiency of Bordeaux mixture as a fungicide, and does not increase it, as has often been supposed. But, of course, where Codlin moth and similar pests have to be fought, it may be that the mixture of Paris Green and Bordeaux may be the best to use.

If we turn to previous experiments in this line, and compare them with the present, it is found that the addition of salt has been highly satisfactory. At Pakenham, in 1901, which was a remarkably bad season for black spot, the addition of 3 lbs. of salt yielded 100 per cent. of marketable fruit, and although the ordinary Bordeaux mixture did the same, yet the addition of salt yielded 67 per cent. of absolutely clean fruit, as against 57 per cent. in the other.

In the preparation of the various modified Bordeaux mixtures, the added substance was dissolved in the copper solution; but in the case of the salt it was added to the milk of lime. The results obtained from the Copper-soda solution are worthy of note. It was tried at Killara as well; but unfortunately the weight of the clean and spotted fruit was not accurately ascertained, so that for the past season only the one record is available. It is considerably behind the Bordeaux mixture in effectiveness, the proportion of absolutely clean fruit being as 86 to 90·4. It is prepared similarly to Bordeaux mixture, the washing soda replacing the lime, and the formula

generally recommended for use is 6· 9· 50, that is, 6 lbs. bluestone, 9 lbs. washing soda, and 50 gallons water. Its great recommendation is that it is a solution, and not a mixture, and has therefore no tendency to clog the nozzles, and may be used in localities where fresh lime is difficult to obtain. But on the other hand it has not the adhesive property of the Bordeaux mixture, and leaving no perceptible deposit when the spray has dried, it is impossible to see if the work has been thoroughly done—no small matter in a large orchard.

This season (1903) the same experiments have been repeated, with the addition of various strengths of the Bordeaux mixture. The one generally and successfully used by me has been the 6· 4· 50 formula, but the stronger one of 6· 4· 40 has also been used. In a Bulletin just come to hand from the New Jersey Agricultural Experiment Station, dated June, 1903, the standard formula given is 6· 4· 60, but as the American gallon of water weighs only 8⅓ lbs., as against 10 lbs. for the English, this American standard, 6· 4· 60, is the same as our standard, 6· 4· 50.

There is another combination known as Soda-Bordeaux, which has also been tried, in which commercial caustic soda is used in connection with the bluestone, and a small proportion of lime may be added to render the mixture perfectly safe.

II.—Killara Experiments.

The main object of the experiments here was to demonstrate on a large scale the treatment which had already proved itself so successful upon a limited number of trees, and to this end a spraying plant was fitted up, so that the necessary operations could be performed expeditiously and successfully. Every facility was afforded by Mr. Syme for the proper carrying out of this object, and at the same time tests were made on a small way similar to those at Doncaster, and the effect of spraying trees in bloom was also observed.

Spraying Plant.

In a large orchard where spraying operations have necessarily to be conducted within a limited time, it is essential that the mechanical appliances are such as will enable a continuous supply of the spraying material to be available, and the spray-pumps kept constantly at work. A detailed account has already been given in Bulletin 3 of the proper method of preparing Bordeaux mixture, and the precautions necessary to be taken, so that it is only necessary here to show how it may be best applied. The photographs taken at Killara represent a most convenient and inexpensive plant. As will be readily seen, the pump is fitted over a race, and the water is directed into the barrels as required by means of the long shoot. When both lime-milk and bluestone solution have been made, the taps of the barrels are turned, and both of the liquids fall into a wide receptacle at the end of a shoot which is inclined to run the

MAKING BORDEAUX MIXTURE AT KILLARA.

material into the mixing barrel, on the top of which is placed a copper strainer. After thorongh stirring the complete Bordeaux is lifted by buckets into the spray pumps.

Bordeaux Mixture with Various Additions.

A series of experiments similar to those at Doncaster were carried out, but on a different variety of apple. A number of Buncombes were most conveniently situated for the purpose, and since they were said to be fairly liable to black spot, they were selected, and each plot consisted of two trees.

Only one spraying was given on 9th October, 1902, and generally the trees were at that stage when the blossom-buds were here and there showing colour. The two formulas of Bordeaux mixture were tried, 6· 4· 50, and 6· 4· 40, and the resulting difference between the two was very slight indeed. The addition of various ingredients to the Bordeaux showed a slight advantage in every case, that of sal ammoniac being the best, while in the Doncaster experiments common salt had the advantage. However, the differences were generally so small, that the results hardly justify a change from the ordinary Bordeaux.

The unsprayed plot showed only 10 per cent. of black spot, so that the attack was not a very severe one, and the merits of the several mixtures were not sufficiently tested to discriminate between them. There was a good deal of variability in the bearing of the trees, but that was due to other causes than the spraying mixture.

TABLE II.—RESULTS OF SPRAYING AT KILLARA.

Plot No.	Treatment.	Yield in lbs.			Per cent. absolutely clean.
		Absolutely Clean.	Spotted.	Total.	
1	Bordeaux 6· 4· 50	544	26	570	95·5
2	,, 6· 4· 40	669	29	698	95·8
3	,, + 1 lb. Sulphate of Ammonia ..	703	21	724	97
4	,, + 1 lb. Nitrate of Soda..	721	29	750	96·1
5	,, + 1 lb. Nitrate of Potash	635	24	659	96·4
6	,, + 1 lb. Sal-ammoniac..	578	13	591	97·8
7	,, + 1 lb. Salt	506	21	527	96
8	Check—Not Sprayed ..	415	47	462	90
9	Sprayed in full bloom with Bordeaux on 22/10/02 ..	446	5	451	9

Two trees were sprayed on 22nd October with Bordeaux mixture when in full bloom, and although the yield of absolutely clean fruit was not so heavy as in any of the others, with the exception of the check plot, yet the percentage of spot was the smallest, being only 1 per cent. In the various spraying experiments, Mr. Hutt, the orchardist, took a lively interest, and intelligently carried out the operations.

First Appearance of Black Spot.

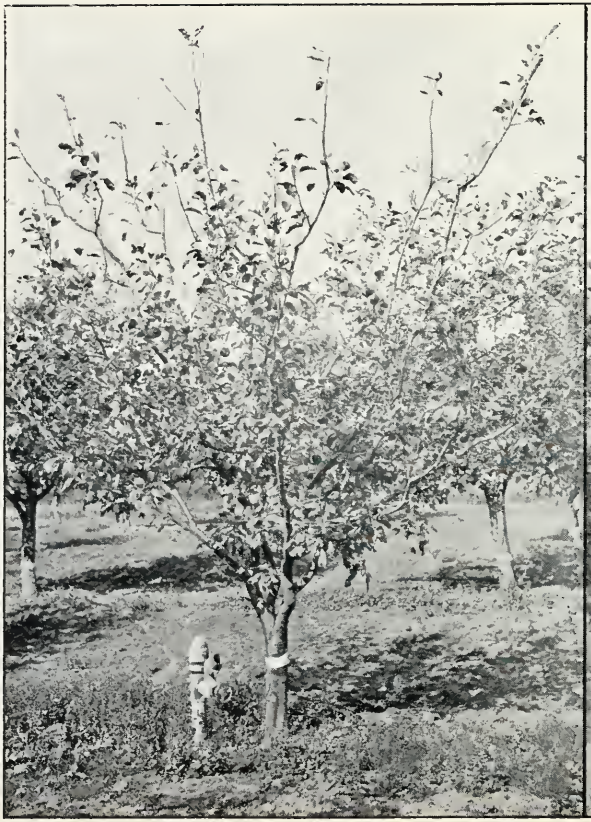
Some orchardists about to give spraying a trial, and who have acquainted themselves with the composition of Bordeaux mixture, fondly imagine that there is some fixed date which is the best time for spraying; but if they considered for a moment what they spray for, then they would see that there is no such thing. The main object of spraying, as I take it, is either to prevent the spores of the fungus from germinating, or to nip them in the bud, just as they are putting forth their delicate germ-tubes, and seeking to penetrate the young and growing tissues. The time at which the germination of the spore happens is largely dependent on the nature of the season, which hastens or retards the development of the fungus, just as it does that of the tree itself. Now, if the seasons were perfectly regular, and the development of fruit trees in different localities uniform, it might be possible to give a definite date, but with the varying seasons and conditions, the most that can be done is to indicate the best time for preventing the development of the fungus. It therefore becomes important for the perfect success of our spraying operations, not only that the Bordeaux mixture is properly prepared, and the ingredients in the right proportions, but that it is applied at the best time for reaching the fungus before it has penetrated the tissues, and gained a footing inside the plant.

Some observations made at Killara on the first appearance of the black spot, in the spring of 1902, will be of interest in this connection. The season there was distinctly unfavourable for the development of the fungus on apples, owing to a dry period in October. At picking time the disease was almost entirely absent from the leaves of nearly all the trees, sprayed and unsprayed alike, only a few spotted leaves being observed, and these were the last to be formed towards the close of the growing season. This attack most probably occurred after the heavy rains of November and December.

The black spot of the pear begins its work earlier in the season, since as a rule the pear is some weeks in advance of the apple. Hence the greater chance of moist weather about the blooming and setting time of this fruit doubtless accounts for the greater difficulty in controlling the disease.

As regards apples, some Ribston Pippins were sprayed on 23rd September, 1902, when the first buds were bursting, but some time before any blossoms had fully appeared, and when examined on 15th October the petals were more than half-fallen, and the fruit mostly set. The black spot was met with on a few leaves enclosing the blossoms, and a photograph of one of these leaves, natural size, is shown on one of the plates.

When spraying at Doncaster, on 2nd October, 1903, when the trees were coming into flower, and about five or six days before full bloom, there was abundance of black spot on the young leaves and fruit-stalks. Many clusters of flowers with not a single blossom expanded bore a plentiful crop of black spot on the stalks and calyx.



NOT SPRAYED.

SPRAYED WITH COPPER-SODA.

SPRAYED WITH BORDEAUX MIXTURE & NITRATE OF SODA.

SPRAYED WITH BORDEAUX MIXTURE.

In the case of the Beurré Bosc pears sprayed on 24th September, 1902, some of the mixture afterwards showed on top of the spot. On 9th October black spot was extremely common on fruits, fruit stalks, and young leaves, when petals had mostly fallen. On another variety growing alongside, name unknown, the black spot was fairly plentiful on the same day, 9th October, though at that time the petals had not quite half fallen, and many flowers were not yet open. Many individual flowers and stalks were plucked, showing the spot before the petals had expanded. Some of these were brought away to be photographed, but unfortunately before this could be done the petals had withered and dropped off.

These facts, however, show that the first infections of the young leaves and flower stalks of the pear must have occurred in the case of the Bosc, prior to the 24th of September, and in the other variety probably a few days later. There seems then no escape from the conclusion that the first spraying of pears must be done as soon as the first blooms begin to expand, and probably if this were followed up by another about ten days later, when the tree would be just about in full bloom, the maximum beneficial results would be obtained. It seems doubtful if the black spot of the pear can be so successfully controlled by one spraying as is done with apples, but further experiments are needed to settle this point. In any case, as the blossoming of the pear is spread over a lengthy period, usually marked by much rain and heavy dews, conditions extremely favourable to the germination and growth of the spores of the fungus, conditions also tending to wash off the spraying material, the advisability of two applications of Bordeaux as before suggested is strongly urged upon growers.

Spraying in Bloom.

A good deal has been written about spraying fruit trees in bloom of a somewhat contradictory character, and it is advisable therefore to state the experience of the past season. When an apple blossom fully expanded was carefully sprayed with an atomiser, so that every portion received the spray, no fruit set, presumably because the top of the stigma was rendered unfit for the germination of the pollen grain either already upon it or afterwards to be carried there. But when a large tree with the blossoms fully expanded was sprayed with a light and fine spray, then the fruit set very well, and no apparent damage was done. With such a mass of blossom as a healthy tree usually bears, a very fine spray distributed over such an extensive surface is not deposited in large quantity at any particular spot, and the number of stigmas rendered unfit to receive or retain the pollen is very small in comparison with the total number, and so the yield is not apparently affected. While it may be quite safe to spray a fruit tree when in full bloom, provided it is done in the form of a very fine mist, yet when one spraying alone is given it is not altogether advisable to do so for various reasons, unless weather conditions have prevented the operation being performed earlier.

In the first place it is rather late, since we have seen that the black spot may appear even before the flower buds have fully expanded.

In the next place there is such a large and extensive surface to cover, that the chances are against its being thoroughly done, and it is the unsprayed spots which form breeding grounds for the fungus.

General Summary.

The results of the season's experiments, as far as they go, tend to show that with a proper spraying plant and a well prepared Bordeaux mixture, the black spot can be thoroughly controlled. Additions such as common salt or sal-ammoniac may slightly increase its efficiency, but they are not necessary.

The first appearance of the fungus, which, as before mentioned, occurred on the apples as soon as the first flowers began to expand, serves to indicate that spraying must be done, in a spring favorable to the black spot, certainly before full bloom, if it is desired to secure the best results.

With pears two sprayings are advised, one just as the first few blossoms show out, and the second a week or ten days later.

Spraying in full bloom may be done and the setting of the fruit is not appreciably interefered with (at least in a dry spring), but it is advantageous to begin earlier when there will be a smaller area to spray, and consequently a smaller amount of material will be required.

As to spraying mixtures, the ordinary 6· 4· 50 formula, with or without the addition of 1 lb. of salt per 50 gallons proved eminently satisfactory. Where good fresh lime is not easily procurable the Copper-soda might advantageously be used. As may be seen on reference to the table giving the results at Doncaster, Copper soda (6· 9· 50) gave 86 per cent. of absolutely clean fruit, which was better than Bordeaux with nitrate of soda 77 per cent., Bordeaux with nitrate of potash (saltpetre) 81 per cent., Bordeaux with Paris Green 83 per cent., and Bordeaux with bichromate of potash 84 per cent.

YATES APPLES.

ONE TREE SPRAYED	- -	314 Lbs. FRUIT.
ONE TREE NOT SPRAYED	- -	24 Lbs. FRUIT.

YOUNG APPLE LEAF WITH BLACK SPOT (NAT. SIZE).

YOUNG PEARS, JUST SET, WITH BLACK SPOT (NAT. SIZE).

COMMERCIAL HORTICULTURE IN VICTORIA.

By C. B. Luffmann.

The Present Condition of the Industry.

Allowing for the limited nature of local population and markets, an unusually large area exists under fruit trees. Nor are there wanting defects in choice of situation and subjects which must ever be inseparable from the settlement of a new country. The most grievous losses have arisen from starting with insufficient knowledge of the fruit industry, and thereby attacking many badly endowed and unsuitable areas. The wide-spread ignorance with regard to the nature and extent of foreign markets, and the absence of co-operation in the matter of production and preparation have also been a common cause of failure, or but partial success. It requires to be frequently and emphatically stated that the remote foreign markets for fresh and dried fruits are limited as to wants and seasons, and highly exacting regarding quality; Great Britain, Germany, and France are the only countries in Europe capable of absorbing a limited number of our fresh fruits, and in exceptional years, certain kinds of dried fruits also. A small trade has already been found, and may be continued at important ports of call on the great sea routes of the Mediterranean, Indian, and Pacific Seas, viz., Naples, Ceylon, Bombay, Calcutta, Madras, Batavia, Hong Kong, and San Francisco. We may also expect a limited trade with South Africa, chiefly in apples, since that country is too hot and arid to furnish the hard fruits which thrive in Victoria.

Of fresh fruits we may, in greater or lesser quantities, regularly export apples, pears, lemons, and grapes; and of dried fruits less regularly, and to fewer quarters, raisins, currants, sultanas, apricots, and prunes.

The canning and preserving industry is in a very fair way to establish itself on a moderate but firm basis, and it does not appear that the State can give much aid in this particular, till communities of growers arrive at a common understanding in the matter of producing and preparing for definite markets.

Up to the present very little has been done in the direction of maintaining heart and vitality in our orchard lands. The average soil and climate demand a constant and heavy dressing of the soil with ingredients other than water and chemical manures can supply. Pig and poultry raising, and the growth of coarse fodder crops provide the only certain means of keeping orchard land in good heart, and the trees in profit over a long term of years. An unduly large proportion of orchards laid out have failed to yield paying returns, solely on account of the deficient nature of the soil.

In the chief fruit growing centres, sufficient experience of useful species and varieties has been gained to ensure much safer planting, and better methods of culture than have been adopted in the past. Still the present state of the fruit industry is not satisfactory to the

larger number engaged in it, nor should it be accepted as such by the State.

The Nature of State Aid.

The average profits arising from commercial fruit growing are not sufficient to attract and hold the rising generation who are bred amidst the work. The young country-bred are not helping out the ideas and labours of their fathers. It is a fact beyond dispute that in the oldest settled districts no more exact knowledge of fruit culture, and no more enthusiasm for the work exists, than in the most modern communities. To keep the native-born on their own acres should be the chief concern of everyone engaged in the work of legislating and instructing; and the work carried out by this branch is directed almost entirely to the establishing of a system of production in strict accord with local natural resources and demands. Under existing conditions the State teacher is frequently powerless to give assistance, since industries have been attempted on impossible areas. A general improvement in returns, average quality of fruit, and more security will not be possible until special groups are formed to deal in common with a limited number of fruits. This may not appear a serious argument till one explains the task of teaching communities of fruit growers, where every man has a different group of fruits, somewhat different wants and ways, and therefore his own self-imposed difficulties to ventilate. Teaching the adult settler is, at the present time, of necessity, scrappy and inconclusive, owing to every address being—if it is to do any good—the merest bits of information to serve the varied wants of the audience.

In so far as eight years' constant experience can furnish a safe guide for future work, it is felt that the State Department of Agriculture will perform good and sufficient work in carrying out the following programme :—

1. The training of orchardists, and instruction of visitors at the School of Horticulture.

2. By continuing to establish and contol small model orchards in all naturally favourable fruit growing centres.

3. By supplying a thoroughly competent travelling Instructor for the senior classes in State schools.

4. By utilising a limited number of railway reserves placed at important junctions, and stopping places, and therein planting and caring for such fruit trees and economic plants, as may be distinctly suited to, and valuable to, the district.

5. By granting to important Rural Societies prizes for the best kept and most profitable orchards, as against prizes for fruit which are of little or no educational value.

If, in the years to come, persistent effort is made in the foregoing directions, the State will have performed its functions to the full, the naturally incompetent settlers and unprofitable areas will be left to other employment, and the industry generally reserved to those who are capable of making it distinctly profitable and permanent.

RINGING THE CURRANT VINE IN GREECE.

By F. B. Wood (British Consul at Patras).

Patras is now the centre of the Currant Trade, and what you call Zante Currants are produced in large quantities throughout most districts of the Peloponnesus. The total average annual produce is now about 160,000 tons, and of these about 140,000 are grown in this Consular district, and only about 20,000 in the Islands of Zante and Cephalonia. The practice of cincturing or ring-barking the currant plant (ring-cutting it is called in this country) dates back about 50 years, and was first introduced to combat the effects of the oïdium blight. In 1852 the entire crop of currants was attacked by this malady, and almost completely destroyed. No remedy was discovered, and the 1853 and 1854 crops suffered equally. In 1855 the sulphur remedy was successfully applied, *i.e.*, sulphur in fine powder sprinkled over the vines with bellows two or three times during the early stages of growth in the spring. The malady was arrested, but the plants, evidently suffering from the effects of this three years' visitation, were much weakened, and only bore very small berried and shrivelled fruit. Some growers, at the instigation, no doubt, of some agricultural school, first attempted ring cutting in 1855—with satisfactory results—the fruit attained much greater development, and when dried the berry was almost double the size of the unring-cut produce. The bold currants gradually grew into favour in most markets, and during the course of the last 50 years the entire currant crop, one may say, is annually subjected to this process. Only in Zante and Cephalonia do they still grow a few hundred tons of unring-cut currants, as they are called in trade.

The process is, of course, anomalous and unnatural, and has proved very detrimental to the vitality of the currant vine, and to the keeping quality of the dried currant. It is very difficult to give accurate figures and statistics in reference to a growth which has really only been under careful scientific observation for the last 30 years; but it is traditionally reported and believed, that the currant vine, before ring-cutting was resorted to, retained its full vitality and full bearing power for a century and more; whereas the present plants begin to show signs of decay after 30 or 40 years. Ring-cut currants, although much bolder than unring-cut produce, are not nearly so sweet, and also lose their aromatic flavour and smell to a great extent. The skin of the berry also, which in the unring-cut currant is very thin and velvety to the touch, becomes coarse and hard to the touch and taste. It is an axiom with currants that the more saccharine matter they contain the better they are in appearance, flavour, touch, and keeping quality. The unring-cut currant, before 1852, used to keep perfectly sound and sweet for ten years or more, whereas the ring-cut fruit begins to fall off after the first year, and is generally unmerchantable after the third season.

It may be pertinently asked why the ring-cutting is persisted in, considering its baneful results to plant and produce; but the answer is that when the system has been once adopted it can no longer be abandoned, without total loss of crop for some years, and this no grower in the country can afford. It must also be observed that the weight produced per acre by ring-cutting is almost double that of unring-cut plants, and this is a compensating advantage which no doubt accounts for the fact that even new plantations are subjected to ring-cutting. Some growers have informed me that cuttings and slips have acquired a hereditary liking to ring-cutting, and that it is doubtful if they would produce without it; but I do not credit this. The ring-cutting is done in this country a few days after the fruit has set, and mostly on the main stem—in some districts it is done on each minor stem, and this, it is said, is less detrimental to the plant. The Peronospora malady * which did such wholesale damage to the currant crop in 1900, is now successfully combated, by spraying the vines with a solution, 1½ to 2 per cent. of sulphate of copper, 1 per cent. slaked lime and water.†

* The Downy Mildew (Plasmopara viticola), one of the most serious vine diseases, probably not existent in Australia, since specimens have never come under the observation of the Pathologist's Branch. —[Ed. *Journal.*]

† A form of Bordeaux Mixture.—[Ed. *Journal.*]

ANIMAL DISEASES AND THEIR TREATMENT.

By A. A. Brown, M.B., B.S.

Symptomatic Anthrax (Blackleg).

Outbreaks of blackleg, particularly in Gippsland, occur every year. Young cattle are principally affected. The disease is limited to the period between six months and four years of age. It seldom, however, occurs over two years of age. It does not occur under six months. It is a disease of damp districts, and occurs mostly in spring and autumn. The germ that causes it is motile, rounded at the ends, with a shining spore at one end. It does not grow in the presence of oxygen. The ox, sheep, goat and guineapig are susceptible, but all other animals are immune. The rabbit is naturally immune to this disease, but it is easily killed by anthrax and malignant œdema. The virus of blackleg lives for long periods outside the bodies of animals, in the soil and water, and, unlike the bacillus of anthrax, thrives where putrefaction is going on, and when deprived of oxygen.

In about 48 hours after the invasion of the virus, distinctive symptoms appear in the affected animal. The disease is contracted by the germs entering through some wound of the skin, such as occasionally exist about the legs and feet of young cattle. Some affected animals recover, so that the disease is not necessarily fatal. The chief characteristic of the disease is the formation of one or more tumors. The swelling rapidly increases in size, and is sonorous on percussion. The centre of the swelling is black, but the outside portions are not so dark. A yellowish-red fluid pervades the tissues in the neighbourhood of the swelling. Much gas is formed in the tumor, and it crackles like a celluloid ball on manipulation. The lymphatic glands of the neighbourhood are involved. The carcase of an animal dead of the disease long maintains its infectivity, and fields where animals have died and been buried, long remain places where the disease is likely to recur. The spores can maintain their existence in the soil for an indefinite period. Diseased animals should be promptly isolated from the healthy. All carcases should be burnt or buried intact in chloride of lime and quicklime deep down in the ground. Cattle should be kept off areas known to be infected, and such areas should be cultivated to lessen risk of contagion.

On the outbreak of disease the remainder of the herd, whose ages range from six months to two years, should be inoculated. Immediately after the death of an animal, take some of the blackest parts of the tumor, pound it well up in a little water that has previously been boiled and cooled, and then filter the mass through linen. This will give a blood-stained fluid. This blood-stained fluid is heated to 200° Fah. for six hours. To compensate for loss by

evaporation during the processing, water at 200° is to be occasionally added. By means of a hypodermic syringe, a teaspoonful, when cooled, of the vaccine thus prepared should be injected beneath the skin behind the shoulder, into each beast, as a preventive of the disorder. A more efficient and permanent vaccine can be prepared by taking pieces of muscle from the swelling and drying them by exposing them to the wind in the sun. This process, however, takes some time to get the vaccine prepared; but by this means a vaccine can always be kept on hand. When the pieces of muscle are dried they are finely ground, and the powder is then subjected to a temperature of 200° Fah. for six hours. The powder is again pulverised as finely as possible, and if kept dry will keep a year or more. The dried powder contains the spores of the germ of blackleg which have been attenuated in virulence by the treatment. The injection of the attenuated virus confers a lasting immunity on an animal over six months of age. The dose is about 1–2 grains of the powder. The powder is mixed up with a teaspoonful of water, and injected beneath the skin. To remove sediment the solution should be filtered through a little cotton-wool before use, so as not to clog the hypodermic needle.

Tetanus.

Tetanus is a disease common to man, and certain of the higher animals. Outbreaks of tetanus or locked-jaw in lambs and sheep occasionally occur, and in cases that have come under notice some considerable number have been affected. At the starting point of infection there is usually œdema. The cause of the disease is a bacillus, the spores of which reside in the earth. Under the microscope the bacillus may appear as a slender elongated rod, or it may have a drum-stick appearance. In the case of animals contracting the disease spontaneously it is found only in the tissue around the wound of entrance. It does not pass into the general system. It acts upon the animal solely through the medium of the soluble poison which it manufactures. The germ does not grow in the presence of oxygen, and it liquefies gelatine. It gains entry into sheep through wounds inflicted during shearing, castration, and other operations. In some cases, indeed, there may be no visible channel of entrance. The presence of a wound, however small, is essential for the virus to gain entrance. The disease generally begins with involuntary spasmodic motions of the head and lockjaw. The jaws may be so tightly locked that they cannot be separated. The head may be drawn backwards through the contraction of certain groups of muscles, or from the contraction of other sets of muscles other peculiar attitudes may be observed. This stiffness may relax, and generalised muscular spasms may come on, followed again by stiffness. Death may occur pretty rapidly, and the post-mortem examination may reveal no appearances of any importance except at seat of infection. On the infliction of a wound during shearing or other operation, the part should be washed with a strong solution of permanganate of potash, and then covered with Stockholm tar.

When the disease actually appears in an animal, no treatment can avail unless antitetanic serum is employed. The use of this serum would be too expensive for ordinary cases, and moreover it would require skill to inject it.

Malignant Œdema.

Malignant œdema is a disease that is frequently encountered in sheep, and is often confounded with anthrax. The malignant œdema germ is often present in the bodies of animals that have died of anthrax. It is derived from the soil, putrefying substances, and the carcases of animals. It is present in the intestines of most animals, and it may in a few hours after death pass into the blood and organs. The animals susceptible to the disease are the guineapig, rabbit, sheep, goat and horse. The germ does not grow in the presence of oxygen, and it liquefies gelatine. It is a long motile organism, and in the blood varies in length. In anthrax the segments are of equal length and non-motile. Spreading from the seat of inoculation, the subcutaneous tissue is found to be extensively infiltrated with a reddish œdema, in which gas bubbles are seen. The hair over the œdematous part is loose, and is readily pulled out. The underlying muscles are intensely red. There may be fluid in the belly cavity, and a peculiar sickening odor is experienced when the body is opened. The lungs are pale, the spleen is soft, and the liver dark. A vaccine prepared by heating cultures up to 230° Fah. can be made, but prevention of the introduction of the germ into the body is the method that must be observed in practice. All wounds should be washed with strong solutions of permanganate of potash, and then covered with Stockholm tar. The germ gains entry into the system by means of wounds.

POULTRY KEEPING.

By A. Hart.

Selecting and Raising Stock.

The selection of suitable stock for table or egg production is a point which must be observed. White Wyandottes, Buff and Jubilee Orpingtons, Black Orpingtons, Langshans, Indian Game, Dorkings, Houdans, Wyandottes, and Old English Game are all good table birds, and they take rank in the order named. Leghorns, Andalusians, Minorcas, Anconas, Black and other Hamburgs and Campines are all good egg-producers. Crosses of these breeds will tend to make the stock hardier, and if table and egg-producing breeds are mated together they should produce an excellent all-round fowl. Always use pure stock on one side, and if on both, so much the better. It is always preferable to keep a flock of fowls of one colour or breed.

In starting a yard of fowls for egg production, it is the better plan to use pullets as the foundation. Select early hatched birds, and they will come on to lay when eggs are scarce and dear. The first laying of pullets should not be used for setting purposes, as the chickens hatched from them will have a tendency to be weak and of inferior quality. After the pullets are fully developed, which will be when they are from eight to ten months old, the eggs may be put down with safety. In mating, always place a second season cock with first season females, and the result will generally be satisfactory.

Incubators are to be recommended, providing reliable machines are used. Turkeys are also very useful for hatching purposes, and on farms where a limited number of eggs are put down, they are specially suitable. They cannot be relied upon as mothers, and hens should be used for this purpose. Where incubators are used, foster-mothers are also necessary. Great care must be taken to keep a correct temperature. Never have the heat too great, as the chicks will stand the cold much better than extra heat. Over-heated chicks are always delicate. The temperature of the foster-mother may be reduced as the chickens grow and develop, and in five or six weeks they will not require any artificial heat. Never liberate the chicks in the open when the weather is cold and severe. The sudden change is likely to produce a chill, resulting in colds and other ailments. They may be allowed to run in the shed where the foster-mother is kept until the weather is favourable for them to be liberated.

Feeding and Housing.

The feeding and housing of poultry have also a material influence on the success acquired. The best food for laying hens is grain, and the best quality is always the cheapest in the end. Wheat takes front rank, and English barley, stout oats, maize and peas are also good, and a change from wheat to any of the latter grains may be

occasionally practised. Pollard, bran and oatmeal are very suitable for soft food, and they should always be mixed with warm water or skim milk during the cold months. The addition of a little salt in the soft food is beneficial. Meat or green-cut bone can also be recommended. Meat should be given in a cooked form. The better plan is to boil it for three or four hours, and then shred the meat fine. The broth will furnish an excellent liquid for mixing the pollard, bran, or other meal. Green food should also be used regularly, and the refuse from vegetables used for table can be boiled up and mixed with the soft food. Lucerne hay cut up fine and boiled or steamed will make an excellent substitute for green food. A V-shaped trough should be used for either feeding with soft food or grain, and failing that, a broad board may be utilised to keep the food clean. Water is also a very necessary adjunct to the general health and condition of poultry, and the supply given should be cool, fresh and pure. Iron vessels are to be recommended, and the rust will furnish the water with properties which are beneficial to poultry.

Housing must receive special attention. The buildings used must be warm and commodious to ensure egg production in the winter months, and although a certain quantity of ventilation is required, care should be taken to exclude draughts of any sort. A suitable building may be made with walls about 6 feet high, and 10 feet by 6 feet in area. The front should be towards the east, and the roof may be either single or V-shaped. If the former, the slope should be towards the back, and in any case spouting should be affixed so as to utilise the water, and also prevent damp or soakage. The house can be made of weatherboard, palings, or hardwood, with an iron roof. The front may be either wholly or partially closed as required, and a door affixed so that the stock may be confined or released at will. Perches should be made all on one level, and they may either be fastened on a frame hung from the roof, or placed on a post at each corner. The perches should not touch the outer walls, and a space of 15 or 18 inches should be left right round the frame. Warm housing will tend to earlier and also increased egg production, and it will also reduce the quantity of food necessary to keep fowls in proper condition. Poultry should not be allowed out of their house too early, when frost or cold and wet weather occurs. Houses should be constructed of iron in tick-infested districts.

Poultry Runs.

The runs for poultry will, of course, have to be arranged according to the area available. Colonies or flocks of fowls should not exceed 100, and if only 50, so much the better. A run about 30 feet by 100 feet will be sufficient for 25 or 30 fowls, and the size of the run should be increased in proportion to the number of birds kept. Shelter should be provided by the planting of shrubs, trees, hedges, etc. Tree lucerne can be recommended for this purpose. It is hardy and of quick growth, and the leaves are very suitable for poultry. By cutting the tree back on the top, an undergrowth is encouraged,

and shelter as well as food is produced. Change of runs is also necessary to ensure the health of poultry. After fowls have been constantly on the same ground for some time the soil will become foul, and the stock are apt to contract disease. This can be avoided by changing the fowls to another run for a couple of months during the year. Remove the birds about the middle of June, and turn the run over with either plough, spade, or fork. Then sow it down with either rye or prairie grass. Allow it to rest till the middle of September, when the grass will have a good roothold. The run will not only be freshened, but it will also provide the stock with a good supply of green food. Grit must also be furnished, and a regular supply is necessary to aid digestion. Quartz grit or sharp gravel is the best, and shell grit, broken crockery and old mortar pounded up is useful. A dust bath is a very necessary adjunct. A box about 3 feet x 5 feet, with sides 6 inches high, will a handy sized one, and this should be filled with equal parts of fine sand and wood ashes, with a few handfuls of sulphur added occasionally.

The arrangement of runs so as to economise both time and labour should be observed. In laying out a number of yards, the better plan is to have them about 100 feet long, by 25 or 30 feet wide. They should be arranged in two rows, with the 100 feet running back. A lane or passage should be left between the two rows, and the doors of the pens should open into this, which will allow the pens to be entered easily. The feeding and drinking troughs can be placed along and partly through the fence, and the fowls may be fed and watered quickly by this arrangement without going into the pens at all.

THE AFRICAN TRADE IN EGGS.

By J. Kirk Hunter.

Whilst pursuing my inquiries regarding poultry, I also at the same time gathered all the information I could with respect to the past, present and future of the Egg trade.

I have secured a comparative statement of the imports for 1901–1902 into Cape Colony, Transvaal and Natal, the latter returns being for nine months only. So far I have been unable to obtain the statistics from Orange River Colony and Rhodesia, but the figures given will suffice to show that the trade in eggs, like all other trades in Africa at present, is a rapidly increasing one, and the question for determination by our dealers in that product is by what means they can participate to a larger extent in the very substantial and growing business now being done.

QUANTITY AND VALUE OF EGGS imported into Cape Colony during the years 1901, 1902

Countries whence Imported.	1901. Value.	1902. Quantity.	1902. Value.
	£		£
United Kingdom	2,814	5,724,888	17,319
Hong Kong	—	872	1
Natal	411	40,924	251
New South Wales	316	134,160	621
New Zealand	—	50,000	255
South Australia	173	65,916	393
Victoria	627	101,196	503
Austria	—	8,200	26
Belgium	—	19,200	63
France	126	61,160	214
Germany	102	18,580	141
Portugal	1,463	1,486,950	4,280
Madiera	31,144	6,408,265	29,561
Canary Islands	337	218,925	726
Argentine Republic	21	48,294	101
United States	420	55,080	233
Totals	£37 954	14,442,610	£54,688

TRANSVAAL, for year ending 31st December, 1901–2.

1901.		1902.	
Quantity	Value.	Quantity.	Value.
1,849,524	£14,863	12,249,840	£90,094

NATAL, 9 months ending 30th September, 1902.

2,512,969	£13,413	4,277,888	£18,097

As previously explained with reference to another article, Cape Colony is the only one from which I can obtain a detailed return, showing the amounts imported from each country whence any particular article is imported, but as all the colonies draw their supplies from the same sources, whatever is being done here, and whatever variation is exposed by a comparison of her imports for, say,

the last two years, may be accepted as fairly indicating the conditions in the other colonies unless in the Transvaal, where, owing to the greater and more rapid increase of the population, the ratio of increase of imports is more pronounced.

Madeira Eggs.

A glance at the comparative statement of the importations of eggs into Cape Colony for 1901–2 shows that although Madeira maintains her position as principal contributor to the local requirements, her trade actually suffered a decrease of £1,583, as compared with 1901, whilst the value of the United Kingdom's trade jumps from £2,814 to £17,319. Portugal also shows an increase.

That Madeira still continues to contribute more than half Cape Colony's requirements in eggs, is, no doubt, mainly due to her excellent climatic conditions which assist cheap production, and the favoured geographical position she occupies in the track of the mail steamers, thus possessing ample, regular, rapid, and—being carried on deck—cheap transit for all she can produce.

Notwithstanding these advantages, her trade for the past year shows a decline, and the reason is that the United Kingdom is now landing eggs as cheap as those from Madeira, with the further advantages that by their improved methods of packing they have reduced the percentage of breakage to a minimum, and the eggs themselves are better value, being bigger than those from Madeira, and therefore command a better price in the market.

The Madeira eggs are packed in willow baskets of 20 dozen each. The baskets are lined with paper, and the eggs are packed in rice or other husk, the thin end downwards. They are mostly carried on deck, and, because of the shortness of the trip, and the fresh-airiness of the conditions under which they are carried, usually arrive in good condition. They escape the customary rough handling incidental to the storing of ordinary cargo, and the percentage of breakage is consequently very small. I am assured by one reliable importer that with him it has never exceeded 5 per cent., and generally averages from about 2½ to 3 per cent.

The present cost of Madeira eggs is from 8s. to 9s. per 100, duty (7½ per cent.) paid, Capetown. The baskets are always a good asset, being easily marketable for the carriage of fruit, etc.

English Eggs.

The United Kingdom, as the statistics indicate, is second on the list in value of imports, and showing a very considerable increase on her figures for 1901. This satisfactory result is due, as already stated, to the improved methods of packing, and to the recently adopted conditions under which they are carried. Several methods of packing have been tried, but the one most approved is that of a long case about 6 feet long, 3 feet wide, and 18 inches deep, containing 1,400 eggs each. The cases are divided by wooden partitions of ⅜-inch deal into four spaces, each compartment is lined all through

with straw padding, about 2 inches thick. The eggs are packed in rice husk, and carry exceedingly well, the breakage being very small. They would even carry better were the cases only half the size, as they would be easier handled. So far as freshness is concerned, these eggs give every satisfaction, and this is attributed to the fact of their being carried in a cool chamber at a temperature of about 40 degrees.

Irish Eggs.

These have recently been arriving in the market in considerable quantities, and they are well regarded being of good size—decidedly bigger than those from Madeira. They are packed in light, but strong cases, made of ⅜-inch boards, and containing 30 dozen each. The cases are divided into two compartments by a board of the same thickness as the case. The eggs are packed in cardboard trays of thirty-six spaces each, with five trays in each compartment, the thin end of egg downwards, and filled with chopped hay; each tray is covered with a layer of the same packing, and that is covered with a sheet of cardboard. I saw a shipment packed in this way opened, and they turned out very satisfactorily, the few breakages there were being due to the insufficiency and unsuitability of the packing. The top tray had got on to the eggs in the one underneath, and chipped a few. This is an excellent method of packing, and were ample rice, or other fine husk used, it would be hard to beat. These eggs, like the English ones referred to, were carried at a temperature of about 40 degrees.

Australian Eggs.

So far as Australian eggs are concerned, my enquiries elicit the information that the past experience of those who have tried small shipments is so unsatisfactory as to completely annihilate all desire to continue their importation. For this determination two strong reasons are given:—

(*a*) Our defective method of packing.

(*b*) The faulty conditions under which they are carried.

The one by its crudeness causes a high percentage of breakage, and the other is more calculated to induce decay than to promote preservation. The ill effects of the two together make success impossible.

The bulk of the eggs received from Australia have been packed in casks containing 1,000 each. This is not a suitable package for the carriage of eggs. It is too heavy, and difficult to handle properly. Its rotundity provides the Kaffir with an easy way of shifting it, which, whilst saving his muscle, is not good for the eggs. The packing used has in most cases been bran, and this is unanimously condemned. The moisture it contains generates heat with the inevitable result of destroying the eggs. The same objection has been advanced against straw packing. Several lots of Australian eggs have been shipped to this market in cases, and packed in salt; but that method was no more successful than the bran packing. The

salt "cakes" on the eggs, and in removing it a lot of breakage results.

In other instances preservatives have been used, but their use is strongly condemned. The Managing Director of the biggest baking concern here, which uses large quantities of eggs, informs me that for their purpose of pastry baking preservative seems to spoil the egg, by reducing the albuminous part to a thin watery substance of no value.

With these unsatisfactory experiences and objections attaching to Australian eggs, it will be easily recognised there is very little encouragement for the importer to continue trying them, and no hope need be entertained of securing or developing this trade until our shippers have adopted more effective methods of packing and shipping, and demonstrated their ability to land the eggs in sound condition, and with the minimum amount of breakage.

With the desire to obtain this much-desired consummation, I suggest that those of our export firms who have agents in African ports, should consign a few cases to them packed in different ways, retaining a complete record of the method of packing of each, so that information may be gathered as to the most suitable In this way only can we hope to secure a share of this very substantial business; as when the importers saw that our methods were at least as satisfactory as those used elsewhere, orders no doubt would follow, and a regular and steady trade ensue.

Light wooden cases of two compartments containing not more than 30 dozen should be used, with abundant packing of rice or other husk, thoroughly dried. Both methods of packing—with and without the cardboard trays—should be tried, and arrangements made for them to be carried in a cool chamber at about the temperature named as adopted with the English and Irish eggs, viz., 40 degrees. They must not be frozen. Experiments made here show that to achieve the maximum of success, eggs should not be put on their side, but packed thin end down, and in cases where the cardboard trays are not used each egg should be wrapped in tissue paper in addition to the husk-packing.

The Future of the Trade.

The returns which I have given, although they do not include those of Orange River Colony or Rhodesia, and though those of Natal only cover nine months' importations, are sufficient to show that the trade is one of considerable value. Large, however, as it is, its expansion has been hindered by the scarcity and dearness of supplies. Were eggs more plentiful in Africa, with the usual accompaniment of plentifulness, cheapness, a vast increase of their consumption would immediately be noticeable.

Under normal conditions of price there is, I suppose, no more popular or generally used article of food than eggs; yet, when I was in Johannesburg, a large section of the population was, because of the

abnormally high price, deprived of their use. They were then fetching 7s. 6d. per dozen, and at the hotel where I put up, when eggs were included in the breakfast menu, no more than one would be supplied to each guest. The price may be a little lower now, but it is still sufficiently high to provide a substantial margin of profit for the exporter, importer and merchant.

The farmers, poultry breeders and others interested in the industry in Victoria should recognise that here in Africa there exists an insatiable market for all the poultry and eggs they can possibly produce for years to come. That knowledge should encourage greater production, as it is only by having ample supplies in excess of local requirements that we can hope to establish and maintain an export trade in any article.

Given the necessary surplus for export, it rests with the shippers to contribute their quota of effort towards securing this trade, by adopting such methods of exportation as will induce the buyers to entrust them with their trade. This co-operation of effort of the producer and shipper could not fail to establish Victoria as a market for eggs in the minds of the African importer, and tend to secure a substantial share of the trade in this commodity in this astonishingly non-producing and hungry country.

ANALYSES OF MANURES ON THE LOCAL MARKET.

By F. J. Howell, Ph. D.

In response to a circular letter sent out by the Director to the various Agricultural Societies in the North, requesting that samples of artificial manures should be collected from farmers and sent into me for analysis, 40 samples reached the laboratory, and have received attention. The Societies which responded to the invitation were the Shepparton, Rochester, Murtoa, Kyneton, Nhill, Minyip, Rupanyup, Tatura, Yarrawonga, St. Arnaud and Donald. Nearly all the samples sent in were superphosphates, and the results of the experiments of this office, which clearly pointed to the marked superiority of the water soluble form of phosphoric acid for the dry northern areas, appear to have been widely recognised, and generally accepted as correct by the northern wheat grower.

The Quality of Manures on the Market.

The superphosphates on the market appear generally to be of a high standard, and with few exceptions gave as the result of analysis figures equal to or exceeding those of the guaranteed percentages of the invoice certificate. A serious cause of complaint, however, is the frequency with which manures appear to be sold in the country without the prescribed guarantee. No comparison of the actual contents of the manures with the represented composition has been possible in a number of cases owing to this cause. In the case of 25 superphosphates, where the invoice certificates were available, the results of analysis showed an actual average percentage of 17·10 per cent. of water soluble, and 2·24 per cent. of citrate soluble phosphoric acid. The average of the guaranteed percentages of these ingredients in the 25 samples gave 16·35 per cent. water soluble and 1·07 per cent. citrate soluble. That is, analysis showed the samples as an average to be slightly better than represented. It was noticed, however, in the course of analysis that the samples contained less moisture than the samples sent in by manure merchants. Taking the average of the 25 samples sent in there was a moisture content of 9·43 per cent. only, compared with 12·29 per cent. shown as an average of 25 samples sent in by manure firms. In other words, the superphosphate on the farm appears to have lost moisture, resulting in analysis showing higher percentages of phosphoric acid than the manures would have given with the original content of moisture. Calculated on a moisture percentage of 12·29 per cent., the samples would have shown, as an average, 16·56 per cent. of water soluble, and 2·16 per cent. of citrate soluble phosphoric acid. These figures are lower than the percentages actually found, but still above those of the invoice certificates.

The Use of Nitro-Superphosphates.

The experiments of this branch have clearly shown that the use of nitrogen in the North has either resulted in injury to the cereal crops, or has produced increased yields of so slight a nature that this ingredient cannot as yet be recommended as necessary in this part of Victoria. It is possible that at some future date the question of the addition of nitrogen to the manures at present used on northern soils might require consideration. But the tests which have been carried out by this branch on the effect of nitrogen, in the nitric, ammonia and organic form have not indicated the advisability of applying this ingredient at present to the cereal crops of northern Victoria. Under these conditions farmers cannot be advised to purchase nitro-superphosphates. From the number of samples which have been sent in, however, it appears that farmers are purchasing pretty freely of this class of manure, as 13 per cent. of the samples sent in were nitro-superphosphates. There is a double disadvantage in purchasing this kind of manure—as the farmer is not only paying for an ingredient, nitrogen, which he does not require, but is obtaining his phosphoric acid in smaller quantities, and in less valuable form, than he would in a good superphosphate. The average of the 25 samples of superphosphates, as shown above, gave a percentage of 16·56 per cent. water soluble, and 2·16 per cent. citrate soluble phosphoric acid, while the average of the nitro-superphosphates sent in showed only 10·78 per cent. water soluble, and 4·06 per cent. citrate soluble, with large quantities of insoluble phosphoric acid—a form which in a superphosphate is generally regarded as without value.

A Few Disgraceful Cases of Fraud.

Although, generally speaking, the samples sent in through the Agricultural Societies were of a high standard, there were a few samples received direct from farmers which were practically worthless for manurial purposes, and the conclusion must be drawn that in a certain number of cases, at any rate, the farmer in Victoria is being defrauded by unscrupulous vendors. The most flagrant case of fraud occurred at Tarrawingee, where an article, sold as a high-grade superphosphate, was found to contain only 2·60 per cent. citrate soluble, and 3·91 per cent. insoluble phosphoric acid.

GENERAL NOTES.

Flax Cultivation in Europe.

In the Flanders or Blue Districts of Belguim some farmers take off the seed from the green flax which is immediately put in the steep. Others dry the flax on the field, then take the seed off and steep. The seed is removed in all cases, either by a rippling comb or mallet. In the Courtrai district the seed is taken from the dry straw before the flax goes to be retted in the Lys, and in no case is the flax retted until the seed is removed.

The rippling and rebinding leave flax straw very square and neat. On an average in the Blue District the seed realises, when sold, sufficient to pay the cost of all labor expended on pulling, retting, drying and rebinding, till ready for mill.

Having inspected the Lys and the system of retting carried on there, we are satisfied that no better could be carried out, since a very superior fibre is produced. This system also produces fibre of a uniform color in large quantities. Flax comes from long distances by rail and cart to be retted here. After being dried and the seed taken off, it is then opened, neatly handled and made into bunches of uniform size, bound with three bands then placed on end in crates.

These crates are large moveable wooden structures, 10 x 12 x 4½ feet. When these are filled they are moved into the water. The flax remains in these for seven or eight days, is then carefully taken out, conveyed to the ground to be dried, where it is neatly set up in gates in rows to dry. While it remains in these gates it is turned wo or three times so as to give it a uniform color; it then goes through a similar process to the first, and remains in crates from ten to sixteen days according to the temperature of the water. Occasionally a third similar process is gone through if the second should not prove satisfactory.—*Journal of the Department of Agriculture and Technical Education for Ireland*, June, 1903.

Solids in Milk.

When the "Sale of Milk Regulations" came into force in England in September, 1901, the standard of 3 per cent. fat and 8·5 per cent. non-fatty solids required by the Board of Agriculture was regarded as being very low, and the opinion was freely expressed that the milk of well-fed healthy cows was rarely so poor in quality. It has since been shown that milk is more variable in composition than was formerly supposed, and that a sample representing a single milking may frequently contain a smaller percentage of solids than is required by the Board's regulations. When milk is drawn at equal intervals, the mixed milk of a herd of cows will usually be satisfactory, but if the milk of the individual cows be tested, it will be found to

show wide, and at present inexplicable variations. On this question, some experiments have recently been made by Messrs. Dymond and Bull at Chelmsford, under the auspices of the Essex Technical Instruction Committee. The experiment consisted in testing twice daily, the milk of six Shorthorn cows which were housed, fed and milked under careful supervision and under favorable conditions. Two of the cows were under observation for short periods only. The following figures show the number of times on which the milk of the other four failed to reach the standard :—

	Average daily yield, lbs.	No, of Milk Analyses.	Fat deficient.	Non-fatty solids deficient.
Cow I	30·8	206	8 times	68 times
,, II	28·8	206	117 ,,	52 ,,
,, III	16·6	156	1 ,,	0 ,,
,, IV	18·8	206	0 ,,	0 ,,

The first two animals were in full milk, having calved six weeks before the test began ; the other cows had calved eight months, and were beginning to go dry. The feeding was varied in the course of the experiments, and on several occasions the animals were exposed to low temperatures, but the milk was little, if at all, influenced. The quality depended on the cow, not on the conditions under which she was kept. The mixed milk did not fall below standard during the experiments, but the analyses given indicate that when a herd is largely composed of newly-calved cows the milk may frequently fall below standard.—*Nature.*

Keeping the Milk Cool.

Mr. P. J. Carroll, Government Dairy Supervisor, strongly urges upon dairy-farmers the necessity for covering their milk-cans while in transit from the farm to the factory. The following bye-law of the Colac Butter Factory is instanced by him as showing that in an up-to-date establishment where nothing is neglected that is likely to improve the quality of the product, this covering of the cans is made compulsory upon all suppliers.

> "Commencing on a date, due notice of which shall be given, and extending till the 21st March of the succeeding year, suppliers are requested to cover their milk cans during transit to and whilst awaiting delivery at the factory or creamery with an approved cloth, for preference, white calico. Bags, bagging, or hessian will not be allowed. Irrespective of weather conditions the covers must be used daily, or a fine of 2s. 6d. for each offence in neglect of same will be imposed. The milk-can covers, under no circumstances, must be used for purposes other than specified."

This rule should be adopted at every factory that aims at producing butter of good quality, and when accompanied by proper precautions to insure cleanliness will result in the delivery of the milk in a sound and wholesome condition, from which it will be possible to make a first class article.

Kerosene Emulsion as a Fungicide.

It will be of interest to many to know that Professor Byron D. Halsted, of the New Jersey Experiment Station, U.S.A., has achieved considerable success in treating the powdery mildew or oidium of the verbena, phlox and rose, with a dilute kerosene emulsion made as follows:—

Kerosene	2 pints
Hard Soap	1 ounce
Water	8 gallons

Dissolve the soap in a gallon of boiling water in a small spray pump, then add the kerosene and pump the mixture back upon itself for ten minutes to secure a perfect emulsion. Dilute with the required quantity of water before using. As kerosene emulsion is particularly valuable for checking aphis on roses, the trouble of giving two differing treatments for the aphis and mildew is saved.

Violet Mixture.

Mr. Geo. Massee, of the Royal Gardens, Kew, England, recommends this mixture, prepared according to the formula given below, for treating fungus diseases attacking young seedlings. For similar diseases of our common garden flowers and vegetables, it has frequently been recommended, but, so far as we are aware, has not yet been tried here.

Sulphate of Copper (bluestone)	2 lbs.
Carbonate of Copper	3 lbs.
Permanganate of Potash	3 ozs.
Soft Soap	½ lb.
Rain Water	18 gals.

A Mammoth Poultry Farm.

An illustrated article, in a recent number of the "Scientific American," describes scientific poultry raising as practised on the largest poultry farm in the States, at Sydney, Ohio. On this farm 3,000 Leghorns supply on an average 200 dozen infertile eggs for culinary purposes per day, and 900 Plymouth Rocks produce 450 eggs daily, which the hatchery—a building 480 feet long—converts into 300 healthy chicks. The chicks when a day old pass to the nursery and spend a month in this building, which is capable of holding 6,000 at a time. They then pass to a second building where they remain till three months old. The chickens are not allowed to mix, but are divided up into small colonies, so that if anything goes wrong the mischief is prevented from spreading. The hens are provided with automatic nests, so constructed, that the egg is removed as soon as it is laid; the new-laid eggs are thus collected at once, and are washed, dated, and placed in refrigerators for transport, so that they reach their destination absolutely fresh. Electric light is employed in the testing of eggs, and the progressive poultryman, assisted by the researches of the U.S. Department of Agriculture, feeds his fowls on the most approved principles.—*Nature.*

Fruit Pulp.

Mr. Berry of the Agent General's Office in London reports that owing to the bad English fruit season this year, there is a good demand for fruit pulp in the English markets which is likely to continue for the next six months, and there seems no reason why Victorian shippers should not get a share of the trade.

Apricot.—The present price of French apricot pulp is 25s. to 27s. per cwt. Unfortunately in the past the pulp from Victoria has not arrived in perfect condition, chiefly owing to there being too much water in the pulp and to bad preservation. It is of the utmost importance, if Victorian pulp is to realise the highest prices, that every care should be taken to send the best pulp, well preserved and with the minimum of water in it. The difficulty, met with in the past and which has entailed loss to shippers is the carriage of the pulp from Australia. The tins have in many instances arrived broken and the contents, consequently, useless. It is suggested that smaller tins than the 56 lb. ones used in the past should be tried. The French use 11 lb. tins and although the initial expense would be probably slightly heavier to Victorian shippers, the loss would not be so great should any of the tins burst. The risk of breakage would naturally not be so great, but if it is decided by the shippers to continue using the large tins I would strongly recommend that the corners of the tins be strengthened.

Raspberry.—There is a very good prospect for raspberry pulp, and it is thought by persons in the trade that good prices will continue for some months. The present prices range from 36s. to 40s. per cwt. and are, if anything, likely to rise. The New Zealand pulp having reached the latter figures, and having carried well, there appears to be no reason why Victorian should not also carry well and command as good a market. As in apricot pulp, care must be taken in packing and to strengthen the tins. The price of good raspberry pulp in an ordinary season would be about 25s. to 30s. per cwt.

Black Currant.—There is also a good demand for black currant pulp. The persons best able to form an opinion in London reckon that the prices in January next will range about 50s. to 55s. per cwt.

RAINFALL IN VICTORIA.

MONTHS OF AUGUST AND SEPTEMBER, 1903.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in Aug., 1903.	Average rainfall for each Area for the month of Aug. based on all previous years of record.	Maximum fall recorded within each Area during Aug., 1903.	Actual Average rainfall recorded in each Area in Sept, 1903.	Average rainfall for each Area for the month of Sept., based on all previous years of record.	Maximum fall recorded within each Area during Sept., 1903.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	0·65	1·59	0·98 at Beulah	4·29	0·94	5·15 at Rainbow
B	1·59	2 19	2·60 ,, Goroke	3·61	1.72	4·11 ,, Dimboola
C	2·35	3·25	3·62 ,, Panmure	3·53	2·86	5·38 ,, Stawell
D	3 42	4·01	4·40 ,, Pt. Campbell	2·95	3·71	3·81 ,, Rivernook
E	0·44	1·55	0·85 ,, Charlton	3·31	1·23	3·67 ,, Kaneira
F	0·74	2·46	1·13 ,, Eldorado	3·55	2·06	4·28 ,, Shepparton
F^1	0·89	3 00	1·31 ,, Alexandra	3·17	2·35	3·67 ,, Seymour
F_2	1·21	3·77	1·49 ,, Beechworth	4·62	3·67	5·52 ,, Yackandandah
G	1·50	2·52	2·23 ,, Kyneton	3·59	2·10	4·64 ,, Kyneton
H	1·55	3·19	2·22 ,, Daylesford	3·97	3·05	4·53 ,, Kilmore
I	0·81	2·29	1·48 ,, Ballan	3·32	2·55	5·52 ,, Ballan
I^1	1·84	2·98	2·36 ,, Grantville	3·43	3·25	4·15 ,, Lilydale
K	2·93	4·77	5·77 ,, Foster	4·50	4·72	7·06 ,, Warburton
L	1·22	2·40	2 26 ,, Traralgon	4·60	2·89	6·29 ,, Cunninghame
M	—	2·72	0·86 ,, Gabo	—	3·08	2·76 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F_1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F_2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville. and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I_1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

EXPORTS OF PERISHABLE PRODUCTS DURING THE FINANCIAL YEARS 1901/2 & 1902/3, AS PER CUSTOMS' FIGURES.

Item.		Quantities.		Values C.I.F.	
		1901/2.	1902/3.	1901/2.	1902/3.
Butter	lbs.	24,981,449	19,183,399	1,665,438	1,278,059
Milk and Cream (Fresh & Frozen)	galls.	35,518	14,053	1,183	468
Milk (Concd. & Presd.)	lbs.	1,255 382	1,505,222	23,008	28,018
Cheese	,,	378,847	1,537,694	7,892	32,035
Eggs	gross	5,542	4,944	3,325	2,966
Poultry and Game ..	value	£18,769	£15,868	18,769	15,868
Pork	centals	1,731	568	2,885	946
Bacon and Hams	lbs.	3,082,888	3,284,427	94,775	123,166
Rabbits and Hares	pair	2,177,669	4,063,417	136,104	253,962
Meats —Fresh and Smoked	cental	268	469	446	781
,, Frozen Mutton and Lamb	,,	130,818	137,694	163,522	172,117
,, Beef and Veal ..	,,	3,955	12,861	6,591	21,435
,, Preserved ..	,,	3,420,781	3,296,774	57,013	54,946
Fruits.—Fresh	bushels	186 076	318,896	46,519	79,724
,, Raisins	lbs.	1,049,676	1,821,117	26,242	45,527
,, Currants	,,	360	55,703	9	1,392
,, Other Dried	,,	408,998	965,462	11,929	28,159
,, Pulp	,,	1,405,543	2,052,301	17,569	25,653
				£2,283,219	2,165,312

SUMMARY.

Item.	Value, 1901/2.	Value, 1902/3
Dairy Produce	1,817,275	1,481,616
Rabbits and Hares	136,104	253,962
Meat	227,572	249,279
Fruit..	102,268	180,455
	£2,283,219	£2,165,312

PERISHABLE AND FROZEN PRODUCTS DELIVERED FROM THE GOVERNMENT COOL STORES, FOR THE MONTHS OF JUNE, JULY, AUGUST & SEPTEMBER, 1903-1902 RESPECTIVELY.

Produce.		June.		July.		August.		September.	
		1903.	1902.	1903	1902.	1903.	1902.	1903.	1902.
Butter (Victorian)	lbs.	276,360	458,024	439,600	59,808	366,016	76,160	793,912	74,312
,, (Ex Bond	,,	—	—	8,400	150,920	—	—	—	7,896
Milk & Cream ..	cases	916	761	1,002	530	708	614	778	845
Pork	carcs.	66	14	388	—	35	34	—	—
Veal	,,	108	80	53	81	34	20	250	37
Eggs	dozen	24,876	2,060	9,849	108	650	75	—	—
Poultry & Game ..	head	3,012	4,863	45	9,007	1,396	—	108	5,854
,, ,, (Ex-Bond)	,,	—	—	—	5,925	—	—	—	3,705
Mutton & Lamb..	carcs.	1,088	585	2,572	72	718	364	7,305	404
Beef	qrtrs.	192	40	241	81	555	80	257	54
Meats (sundry) ..	lbs.	8,017	7,978	9,729	11,973	3,429	7,234	7,710	6,768
Rabbits & Hares	pairs	224,064	328,397	263,994	331,228	254,964	303,528	79,488	171,421
Fruit (fresh) ..	cases	230	425	—	—	—	—	60	—

ARRIVALS OF BUTTER and Butter ex-Cream in tons net, by Rail and Steamer in Melbourne from the different districts in Victoria, for the first nine months of the years 1903 and 1902 respectively.

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and South-Western.	
	1903.	1902.	1903	1902.	1903	1902.	1903.	1902.	1903.	1902.
January ..	1,792	1,621	306	257	56	106	836½	765	593½	493
February ..	1,373½	1,269½	90½	196	47½	50	814	630	421½	393½
March ..	1,370	977½	112	92	27	25	740½	650	490½	210½
April ..	910½	597½	140	60	14½	16	443	359	313	162½
*May ..	444	670	92	95	9	13	204	421	139	141
June ..	595½	473	118	40	13½	22	213	247	251	164
July ..	561½	435½	106	54½	16½	17	179	190	260	174
August ..	641	468	163	99	33	24	122	122	323	223
September ..	1,035	1,042	257½	216	64½	63	272	267	441	496
Totals:	8,723	7,554	1,385	1,109½	281½	336	3,824	3,651	3,232½	2,457½

*During May, 1903, about 350 tons of Butter were sent to Melbourne by road whilst the Railway Strike was on.

EXPORTS OF PERISHABLE AND FROZEN PRODUCTS DURING JUNE, JULY, AUGUST, AND SEPTEMBER, 1903 AND 1902 RESPECTIVELY.

Produce.	June.		July.		August.		September.	
	1903.	1902.	1903.	1902.	1903.	1902.	1903.	1902.
Butter .. lbs.	780,660	328,160	814,344	263,459	1002,580	415,618	1,812,356	1393,759
Cheese .. ,,	93,960	46,224	54,960	41,753	32,880	29,062	43,320	34,474
Milk & Cream cases	412	240	230	177	619	624	1,058	840
Ham & Bacon lbs.	75,600	24,340	45,800	24,340	70,320	48,342	79,600	56,324
Pork .. cars.	90	—	360	25	69	40	62	—
Veal .. ,,	167	93	121	171	59	204	1,305	248
Eggs .. doz.	1,100	–	—	—	—	—	—	—
Poultry & Game head	21,735	6,000	4,545	12,705	5,070	9,585	9,525	6,480
Mutton & Lamb cars.	9,205	4,465	10,801	7,068	32,849	2,526	20,995	9,850
Beef .. qrtrs.	268	148	377	140	894	191	4,026	1,450
Rabbits & Hares pr.	317,208	313,128	557,364	949,728	412,932	601,572	237,588	280,548
Fruit (fresh) cases	9,472	3,177	6,124	4,624	2,712	1,800	2,259	1,212
,, (pulp) ,,	230	--	634	—	—	—	5,496	—

Fruit and Plants.

EXPORTS TO AUSTRALIAN STATES AND NEW ZEALAND ONLY INSPECTED DURING JUNE, JULY, AUGUST AND SEPTEMBER.

Fruit.	Cases or Packages Inspected.				Certificates Given.			
	June.	July.	August.	Sept.	June.	July.	August.	Sept.
Apples .. cases	2,720	2,162	1,078	334	67	70	49	48
Bananas .. ,,	1,621	899	1,878	1 057	121	185	176	212
Cucumbers ,,	—	—	1	29	—	—	1	13
Grapes .. ,,	1	—	—	—	1	—	—	—
Lemons .. ,,	797	846	1,214	1,136	89	98	97	115
Melons .. ,,	8	12	12	—	5	1	2	—
Oranges .. ,,	898	1,785	1,395	1,984	117	152	173	202
Passion Fruit ,,	49	83	88	63	23	23	30	30
Pears .. ,,	932	369	30	—	52	27	10	—
Persimmons ,,	4	—	—	—	3	—	—	—
Pineapples ,,	365	138	192	251	72	64	72	86
Quinces .. ,,	52	—	—	—	5	—	—	—
Tomatoes.. ,,	—	—	32	63	—	—	11	24
Total Cases Fruit	7,447	6,294	5,920	4,917	555	620	621	730
Plants .. pkges	259	229	1	11	117	66	1	5
Totals ..	7,706	6,523	5,921	4,928	672	686	622	735

J. G. TURNER for C. FRENCH.

EXPORTS OF FRUIT BEYOND THE AUSTRALIAN COMMONWEALTH AND NEW ZEALAND FOR JUNE AND JULY, 1903.

Fruit.	South Africa.	Java.	India.
Apples	150	150	184

J. G. TURNER

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No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
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Report on the Export of Frozen Produce from Victoria, 1896–7. D. Wilson
Do. do. do. do. 1897–8. do.
Do. do. do. do. 1898–9. do.
The Beet Sugar Industry in Victoria. By A. N. Pearson.
List of Exporters of Agricultural Products.
The Scientific Directing of a Country's Agriculture. By A. N. Pearson.
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Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
Chart for the Guidance of Dairymen. By R. Crowe, Dairy Expert.
Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
Report of Conference on the Elevator System in the Handling and Shipment of Grain.
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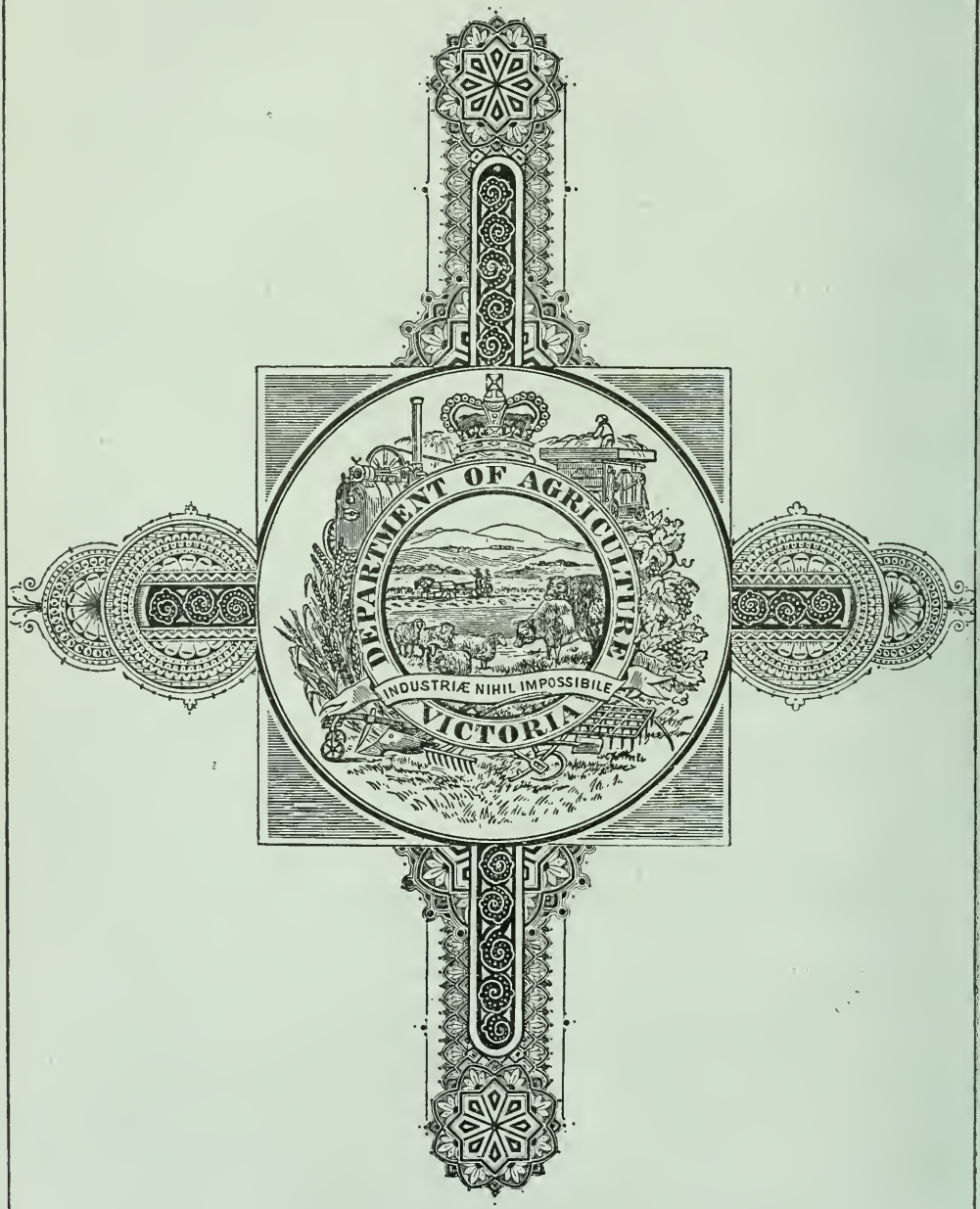
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THE SHORT COURSES OF INSTRUCTION TO FARMERS AND FARMERS' SONS.

By F. E. Lee.

The short courses of instruction to farmers and farmers' sons, held throughout the State during the past winter months, have met with such unqualified success, that a review of the aims and objects of the movement is appropriate.

It has been apparent for years past, to students of Victorian agriculture, that a radical change was necessary in order to place the standard of farming on a higher scale. How to bring about this change, and to still retain the sympathetic co-operation of the farmer himself was the problem. The proverbial aversion of the farmer to innovations was the chief obstacle to overcome—this done, and the monetary advantages of the change made manifest, the rest was easy.

Matters were at this stage some few years ago, when the use of artificial manures, improved methods of cultivation, and use of the grain drill were advocated throughout the Northern grain districts by a series of vigorous lectures. There is little need to recall the enthusiastic response that was accorded to the efforts of those who formulated and carried out the pioneer work in these directions. The restoration of his almost worn out soils by artificial aids, revealed to the practical farmer the advantages of the application of scientific methods to his business. The demand for information in the shape of lectures increased rapidly, and the advice was eagerly made use of.

Following on the practical benefits derived from scientific methods properly applied, came as a natural sequence, the desire of the farmer to have his sons instructed in modern methods of agriculture.

To meet this growing demand for information, the present short course system of lectures was instituted, and judging from results, seems to have filled a long-felt want.

Inauguration in Victoria.

Inaugurated by Mr. Williamson Wallace, shortly after his appointment as Director of Agriculture, the idea was first put into effect during the winter months of 1902.

The winter months were selected in which to hold the classes, as at that time farm work is less likely to be disturbed than at any other period of the year.

It was decided by the Director to conduct the classes under the auspices of the country Agricultural Societies whose co-operation in the movement was secured by an invitation addressed to them to secure the names of farmers, farmers' sons, or persons working on

farms, who were desirous of having the short courses of instruction established in their district. A class was promised to each of the three districts securing the greatest number of students. Being warmly endorsed by the country press, and well received by the farmers themselves, the movement was a popular one throughout the farming districts. Out of a number of districts, Tatura, Bacchus Marsh, and Charlton were successful in having classes allotted to them.

The Subjects Dealt With.

A programme of lectures was drawn up, embracing all subjects appertaining to agriculture in the broadest sense of the term. The value of tillage, advantages of a rotative system of cropping, uses and valuation of artificial manures, results of manurial experiments in Northern, Central, and Southern Victoria, dairying, the breeding and management of live stock, viticulture, poultry management, agricultural botany and chemistry, as well as the diseases to which the various crops are subject were all dealt with. In addition to these subjects on which lectures were given, there were practical demonstrations of vine pruning, cattle speying, and the preparation of poultry for table use and for export, held during the Course. The lecturers were drawn from the different branches of the Agricultural Department, one or two gentlemen from outside being also included.

The First Classes.

The first class was opened by the Director in person, at Tatura, on August 26th, 1902. A considerable amount of interest and enthusiasm was manifested in the new idea by the farmers of the surrounding districts, and in addition to a large attendance of students, there were present a number of persons of riper years, desirous of making themselves acquainted with the more modern methods of their own business.

The attendance of students throughout the class was well maintained, though the term of two weeks, was generally considered to be too short to permit of a thorough study of such subjects as agricultural chemistry and botany.

The second class was opened at Bacchus Marsh, on September 8th, 1902, with a large number of students enrolled. Only lectures suitable to the local conditions of farming and climatic conditions were delivered. Although with widely different conditions to the previous class, there seemed to be the same eagerness on the part of the students to better their knowledge in the various branches of agriculture.

The third and last class of 1902 was opened at Charlton, on September 22nd. The spring having by this time well advanced, the effects of the late disastrous drought were just begining to be severely felt. Notwithstanding, however, the poor prospect ahead of them, the farmers of the district welcomed the advent of the classes, and showed their appreciation by maintaining a good attendance throughout the duration of the class.

The Approval of Outside Bodies.

Prior to the termination of the class in each centre, an examination was held, the attendance of students at which was purely voluntary. Recognising the extreme value of technical education in the direction of agriculture, the Australian Natives Association offered a gold medal for competition at all centres, to become the property of the student gaining the highest number of points at the examinations. This incentive was productive of the happiest results, and a number of fine papers were sent in from each centre. A student attending the Tatura class, Mr. A. Baldwin, was successful in winning the A.N.A. gold medal, with a series of highly creditable papers. The medal was subsequently publicly presented to Mr. Baldwin, by the President, at the annual meeting of the A.N.A., held at Daylesford.

It is worthy of note, that the splendid library of approved text books, attached to the class at each centre, was freely made use of by the students, and there is every reason to believe that home reading contributed in no small degree to the success of the examinations.

The Continuation and Extension of the Classes in 1903.

The complete success which attended the classes in their initial year, made it abundantly clear that there was a strong desire on the part of young farmers to better their knowledge of the more theoretical side of Agriculture, but in order to secure more permanent good results, it appeared necessary to not only extend the length of the term of the classes, but to increase the number of centres. The management of all details in connection with the classes, was placed in the hands of Dr. Howell, the Chemist for Agriculture, whose Branch was represented by five lecturers. Applications were again invited through the country Agricultural Societies, with the proviso that unless a guarantee of 40 students, over the age of 16 years, could be given, no class could be allotted. A sum of £500 was placed at the disposal of the Director by the Council for Agricultural Education for the purposes of meeting and defraying the expenses in connection with the classes.

The following districts gave the required guarantee, and classes were allotted to them—Boort, Warrnambool, Maffra, Shepparton, Geelong, and Kyneton.

The lecturers were Messrs. Lee, Garnsworthy, Robertson, Osborn, and Trend, of the Chemical Branch; Messrs. Archer (dairying) and Hart (poultry), of the Dairy Branch; Adcock, Viticultural Branch; Meeking and Cock, Entomological Branch; with Haile (wool sorting), and Hawkins (poultry), of the Working Men's College.

Dr. Cherry also delivered a lecture at Maffra, Warrnambool, and Kyneton, on dairying.

Range of Subjects and Term of Class.

The programme provided for three lectures per day of an hour each, in the afternoon, for a period of four weeks, at each centre. The subjects covered a broader field than the previous year. Special prominence being given to the latest manurial experiments in the Northern, Central, and Southern portions of the State—the feeding and composition of suitable rations for stock—wool-classing—poultry breeding, and Agricultural Chemistry.

The Class at Boort.

Having been deputed by the Director to open the classes in each centre, the writer of this article opened the first class at Boort, on June 2nd. From the outset the class was well attended, improving in fact as the term progressed. It was pleasing to number among the students who attended daily, the President, Vice-President, and some members of the Committee of the Boort A. & P. Society. At the conclusion of the class, resolutions were moved by the students, expressive of their appreciation of the efforts of the Director in affording them the opportunity of obtaining the most modern information relating to agriculture.

Mr. Robertson, who had for a time conducted the class, was presented with a pipe by the students, as a mark of their appreciation of the painstaking manner in which he had done his duty. The number of students who submitted themselves to the voluntary examination during the last week of the class, and the number of points awarded in each subject, will be found in the sub-joined tables.

The Class at Warrnambool.

The Warrnambool class was opened on June 22nd, with a large number of students enrolled. Lectures suitable to the soil conditions, climate, and range of crops only were delivered.

Here, again, the President of the A. & P. Society showed his sympathy with the object of the class, by attending frequently and bringing numerous visitors.

The average daily attendance of students for the term of the class was not as good as it might have been, an explanation for which might be found in the difficulty that many of the students experienced in absenting themselves from home, while carrying on business as dairymen. It will be remarked that at other centres where the dairying industry is an all important one, the average daily attendance has been low, so that doubtless the explanation given is a most feasible one. In the purely farming districts, the daily attendance was more regular. The results of the examinations will be found below. Prior to the closing of the class, resolutions were passed by the students, thanking the Director for allotting a class to Warrnambool, and Mr. Osborn, on behalf of the lecturers, for the valuable information which had been imparted.

The Class at Maffra.

The Maffra class was opened on June 29th. Being a dairying district the attendance of students was never very large, although a fairly large number attended intermittently. Students from Sale, Cowwarr and Briagolong (all places 12 to 16 miles distant) attended frequently.

The class was brought to a close with votes of thanks on behalf of the students and of the A. & P. Society to the Director for his efforts on behalf of the agricultural community.

The Class at Shepparton.

The Shepparton class was opened on July 20th, in the presence of the President and Vice-President of the A. & P. Society, prominent townspeople, and a large gathering of farmers and students. The attendance of students was most regular and punctual throughout the duration of the class.

The number who submit themselves to the voluntary examination is perhaps the best guide as to the interest shown by the students in the work.

Some 50 per cent. underwent examination, an extra incentive no doubt being a gold medal offered by the Hon. George Graham, M.L.A., for the student gaining the highest number of marks at the Shepparton class. As will be seen elsewhere, Mr. A. S. Crooks gained not only Mr. Graham's medal, but also the gold medal offered by the Australian Natives Association for the best student at any class in the State, with the splendid record of 674 marks out of a possible 700.

The Shepparton Agricultural Society, on the occasion of the local show, some two months after the termination of the class, entertained the Director and a number of the lecturers at a social, during which the high value of the work initiated by the Director was specially commended. Mr. Garnsworthy, the lecturer on chemistry was presented with a travelling clock by the students as a mark of their esteem for his efforts on their behalf.

The Class at Geelong.

The class at Geelong, which was held in the Gordon Technical College, kindly placed at the disposal of the Director, was opened on July 27th. Previous to the opening of the class the lecturers were entertained at luncheon by the Agricultural Society. Speeches thoroughly endorsing the system of technical education and in cordial approval of the efforts of the Director were made by the President of the A. & P. Society and other prominent gentlemen present.

The attendance of the students was uniformly good and regular, many coming long distances daily by road and rail. A gold medal was donated by H. M. Sutherland, Esq., for the student gaining the highest number of marks at the Geelong class.

Special classes in chemistry and woolsorting were held during the morning for those students who were desirous of following up those subjects more thoroughly and to occupy the time of students

coming from other towns. These special lectures, which were delivered by the gentlemen attached to the Gordon College on those subjects, were fairly well attended.

The number who submitted themselves to examination and the general good standard of the papers is an indication that the lectures were closely and intelligently followed.

Mr. Osborn, the lecturer in chemistry, was the recipient of a gold medal from the students attending the class to mark their appreciation of the manner in which the class had been conducted while in his charge. Resolutions were also passed by the students expressing the opinion that they had received a mass of most useful and practical information, and hoping that the class would be held in Geelong another year.

The Class at Kyneton.

The class at Kyneton was opened on August 17th. The attendance of students was most satisfactory up to the period when the class was adjourned for a week for the Melbourne show; after resuming the number attending fell off considerably. The lateness of the season, combined with most unfavorable weather conditions also militated against regular attendance.

A gold medal for the most successful student attending the Kyneton class was donated by J. Thomson, Esq., of Kyneton. By the results of the examination it will be seen that the Kyneton class compares very favorably with other centres.

Before closing the class hearty votes of thanks were passed by the students to the Director and to the lecturers, particularly Mr. Trend, who had been some time in charge at Kyneton, for their unfailing courtesy at all times.

A Criticism of the Work in 1903.

There was every cause for congratulation on the work of the classes in 1903. The extension of the term to four weeks and the regular attendance of students during that time proved unmistakably the value set on the information by the students themselves. The splendid response to the voluntary examinations and the generally high standard of the papers were most gratifying to the lecturers.

The tables given below will bear out in every particular the statements that have been made regarding the interest and attention shown in the work.

The average daily attendance at the various centres was: 42 at Boort, 25 at Warrnambool, 19 at Maffra, 47 at Shepparton, 35 at Geelong, and 20 at Kyneton. These figures do not include the numerous visitors and the large gatherings of ladies who attended some of the lectures, those dealing with poultry in particular.

In a series of examinations on multifarious subjects it is perhaps of interest to note how the particular subjects were answered from the point of view of numbers. Comparisons of one centre with another will show that approximately about 50 per cent. of the students submitted themselves to examination.

NUMBER OF STUDENTS EXAMINED AT VARIOUS CENTRES.

CENTRE	Agricultural Subjects & Animal Nutrition.	Poultry Breeding and Management.	Sheep Breeding and Wool Sorting.	Agricultural Botany and Viticulture.	Dairying.	Insect Pests and Plant Diseases.	Theoretical & Agricultural Chemistry.
	Mr. Lee	Mr. Hawkins	Mr. Haile	Mr. Adcock	Mr. Archer.	Messrs. Cock and Meeking	Messrs. Osborn, Robertson, Garnsworthy, Trend
Boort ...	25	21	21	21	21	20	21
Warrn'mbool	16	15	15	10	15	12	10
Maffra ...	6	6	6	5	5	6	5
Shepparton	23	22	22	22	22	22	22
Geelong ...	23	20	20	20	20	18	19
Kyneton ...	12	12	10	9	10	10	9
Total ..	105	96	94	87	93	88	86

A criticism of the above figures reveals two interesting facts. First, the unqualified support given to the subjects of poultry breeding and wool-sorting and sheep breeding, dealt with by Messrs. Hawkins and Haile respectively, and secondly the high place attained by such subjects as chemistry, botany, entomology and vegetable pathology.

The management of the poultry yard is for the most part left entirely to the farmer's wife, and hardly comes within the idea of the farmer himself as part and parcel of the farm. Mr. Hawkins, however, invested his subject with such a fund of practical information that in the future the poultry industry on the farm will be regarded as something well worth the trouble of developing. The number of letters received since the classes closed is evidence enough that a decided stimulus has been given to this branch of farm husbandry.

Sheep breeding and practical demonstrations in sorting and classing wool made Mr. Haile's lectures of particular interest to those students engaged in grazing pursuits. The advice of the expert was so clear and his method of imparting information so lucid that this subject, which is of supreme importance to Australian farmers, became the centre of interest for the time being.

It can only be concluded that the subjects of chemistry, botany, entomology and vegetable pathology met with such a response by the students because it was recognised what an important bearing each of them has on successful agriculture. The control that chemistry exercises over the soil manures and matured crops in determining their values for different purposes, came as a revelation to many students, without any previous acquaintance with the subject. The number of students who underwent examinations in these subjects must be most gratifying to the lecturers who handled them so ably, and left the mark of their own enthusiasm on the class in each centre.

The total percentage of points gained by the class in each centre was: 60·6 at Boort, 56·5 at Warrnambool, 58·9 at Maffra, 62·2 at Shepparton, 60·1 at Geelong, and 57·6 at Kyneton.

From the tables of results appearing at the end of this article it will be seen that the total percentage of marks gained by each class is very uniform. The total in each case speaks volumes for the

general interest taken in the lectures, and is a matter of congratulation for the lecturers themselves.

Extracts from the Reports of Lecturers.

Mr. Lee, writing of the examination papers submitted to him for correction, says: "The answers to the questions were as a rule full and complete. One question in particular, however, proved a stumbling block to the majority of those who submitted themselves for examination, and that was the valuation of an artificial manure from a given imaginary certificate. This being a matter of considerable interest to most agriculturists, it is to be regretted that the method of valuation and the correct unit values was not more thoroughly understood. Questions relating to the feeding of stock evoked some fine answers, showing unmistakably that there is a strong desire to know more of this important side of husbandry."

Mr. Hawkins, the lecturer on poultry breeding and management, says: "The papers examined indicate that the students have given very keen attention to the lectures and have grasped the main points with a considerable degree of accuracy. With the knowledge, which, as evidenced by the answers, they now possess, they should be in a position to make a good and promising start in the development of the poultry industry."

Mr. Hawkins also notes with pleasure the large attendance of ladies, and the interest they showed in his lectures.

Mr. Haile, the lecturer on sheep breeding, and demonstrator in wool sorting and classing, writes most enthusiastically of the papers submitted to him. He says: "As a whole the papers are exceptionally good and great interest was shown in all the demonstrations. I am exceedingly gratified at the result of my examination, which shows in a great measure that the instruction given has been retained." Numerous invitations were extended to Mr. Haile to act as judge in the sheep and wool sections of country agricultural shows, which he was reluctantly compelled to decline.

Mr. G. H. Adcock, whose lectures embraced agricultural botany and viticulture, writes as follows:—"On the whole the papers show that the students have taken an intelligent interest in their work; some of the papers are highly creditable. From numerous enquiries I have had it appears that many of the students propose to continue their study of agricultural botany, thus showing that their interest has been roused."

Mr. Archer, who dealt with the subject of dairying, writes: "I am pleased that many of the answers to questions were particularly good, and indicate that an intelligent interest has been taken in the lectures generally."

Mr. Cock, who lectured on Insect Pests and Plant Diseases at the Boort and Warrnambool classes writes: "I consider the papers highly creditable, and feel sure that more than the usual amount of interest has been taken in the subject."

Mr. Meeking, who dealt with the same subjects as Mr. Cock, at Maffra, Shepparton, Geelong, and Kyneton, writes—"Generally speaking, the questions were fairly well answered; the chief failures being in those relating to the diseases of fruit. Those referring to cereals, root crops, and grasses were, on the whole, well answered."

The subjects of theoretical and agricultural chemistry were dealt with by Mr. Robertson, at Boort and Maffra; Mr. Osborn, at Warrnambool and Geelong; Mr. Garnsworthy, at Shepparton, and Mr. Trend, at Kyneton.

Speaking of those centres where he lectured, Mr. Robertson, says—"The answers received were, on the whole, of a high standard. The questions on theoretical chemistry were, almost without exception, better answered than those on agricultural chemistry."

Mr. Osborn, writing of the papers from Warrnambool and Geelong, says—"The papers as a rule, were of a high order—the students seem to have realised the important bearing that chemistry has on agriculture, and have made a corresponding effort to understand the subject."

Mr. Garnsworthy, writing of the Shepparton class, says—"The lectures were followed with close attention by the students, particularly those dealing with the analysis of soils and manures, and advanced agricultural chemistry."

Mr. Trend, speaking of the Kyneton class, says—"The students took a great interest in the class, and expressed themselves as having greatly profited by the information given. The answers to the questions on chemistry were on the whole well answered, showing that subject had been closely followed."

The Educational Value of the Classes.

It seems abundantly proved, that the object with which the classes were instituted, viz., to afford information and to give advice on all matters relating to agriculture, has been more than fulfilled. The resolutions that were moved by the students themselves, at the termination of the class in each centre, were sufficient guarantee that the information had fallen on receptive ears. The public testimony of the worth of the instruction, cannot fail but to be most gratifying to the instigator of the movement in Victoria.

The method of imparting information by means of short, popular lectures, couched in such language as to be readily understood, seems to have been accepted as being the simplest way of instructing students. At the conclusion of a lecture, questions are invited, and any particular point re-explained. By this means, both students and lecturers are brought into closer contact with one another to their mutual advantage.

The examination papers throughout are the reflex of the interest shown by the students, and the careful following of the different subjects, has been commented on by every lecturer.

The educational value of such courses of lectures as those just concluded, is enormous. In the first place, it brings together a number of young men, for the most part well acquainted with all the practical work of the farm, yet often knowing little or nothing of the "why" or the "wherefore" of any operation. The different operations in the cultivation, preparation, and sowing of a field have each a definite object, and unless the reason for certain manipulations is understood, then success can only be partial, because there is no standard to work up to. That there is a desire for wider and more extended information on agricultural matters is clearly evident.

How this increasing demand will be dealt with in the future, is yet a matter of conjecture, but as a sign of the times it is significant, that Victorian farming shows an all round improvement, both in treatment of the soil, selection of seed, and methods of cropping, and this improvement is without doubt due to the recognition of the fact that what was good enough ten years ago will not answer to-day.

Thanks of the Lecturers.

In concluding this article, I may be permitted to express the deep appreciation of the lecturers of the uniform courtesy and good discipline shown by the students.

Friction of any kind was unknown, and there is every reason to believe that these cordial relations existing between the instructors and the students contributed in no inconsiderable degree to the success of the classes.

Detailed Results of Examinations at each Centre.

BOORT.

Student's Name.	Lee.	Hawkins.	Haile.	Adcock	Archer.	Cock.	Robertson.	Total.	Maximum Number of Marks obtainable.
Taylor, J.	68	90	98	76	60	82	83	557	700
Patterson, J. ..	86	60	99	95	75	54	79	548	,,
Weaver, J.	72	60	90	90	75	51	74	512	,,
Slatter, A.	58	75	98	88	75	48	66	508	,,
Slatter, T.	63	60	95	70	77	49	79	493	,,
Rosengrave, J. ..	59	20	95	80	75	69	79	477	,,
Harvey, H. ..	54	40	99	75	85	64	57	474	,,
Barnes, E.	46	70	85	70	78	53	57	459	,,
Williamson, J. ..	68	50	98	65	65	49	59	454	,,
Bear, G.	44	60	100	45	74	64	62	449	,,
Sutton, W.	63	60	98	50	70	45	57	443	,,
Williamson, R. ..	58	50	98	55	55	34	64	414	,,
Smith, F.	62	50	95	45	77	39	27	395	,,
Allison, T.	72	55	100	20	50	39	59	395	,,
Kirk, W.	65	40	90	60	60	—	79	394	600
Toose, P.	40	60	97	55	70	24	26	372	700
Smith, F. G. ..	49	30	85	60	65	40	24	353	,,
Williamson, L. ..	42	30	100	30	55	34	51	342	,,
Williamson, V. ..	46	20	90	40	45	31	62	334	,,
Slatter, J.	56	30	65	30	40	33	33	287	,,
Town, W.	42	10	80	30	65	31	24	282	,,
Genat, W.	44	—	—	—	—	—	—	44	100
Douglas, S. ..	34	—	—	—	—	—	—	34	,,
Boyle, L.	30	—	—	—	—	—	—	30	,,
Williamson, G. ..	30	—	—	—	—	—	—	30	,,

WARRNAMBOOL.

tudent's Name.	Lee.	Hawk-ins.	Haile.	Adcock	Archer.	Cock.	Osborn	Total.	Maximum Number of Marks obtainable.
Budge, K.	54	65	100	80	84	63	82	528	700
Milne, A	72	70	95	70	69	55	53	484	,,
Barber, N.	61	65	75	83	85	30	67	466	,,
Campbell, A. ..	38	71	90	85	79	35	64	462	,,
Anderson, W. J ..	58	50	82	85	67	50	66	458	,,
Haberfield, J. ..	80	30	93	60	79	40	64	446	,,
Jukes, F. .. .	41	50	80	80	69	50	43	413	,,
McGhie, M. ..	44	40	92	65	34	30	38	343	,,
McPhail, A. ..	30	40	93	50	55	25	32	325	,,
O'Neil, M.	28	60	65	58	42	15	15	283	,,
Henderson, W. ..	43	40	85	—	72	—	—	240	400
McGuiness, A. ..	32	20	70	—	65	25		212	500
McLeod, M ..	30	40	60		77	—	—	207	400
McGuiness, M. ..	46	25	70	—	45	15	—	201	500
McGuiness, R. ..	36	10	80	—	42	—	—	168	400
Trigg, J.	15	—	—	—	—	—	—	15	100

MAFFRA.

Student's Name.	Lee.	Hawk-ins.	Haile.	Adcock	Archer.	Meek-ing.	Robert-son.	Total.	Maximum Number of Marks obtainable.
Evans, F.	87	75	88	96	90	73	89	598	700
Napper, T.	57	70	83	70	82	48	92	502	,,
Steggall, J.	74	70	81	75	60	46	43	449	,,
Napper, A	45	50	50	40	60	29	58	332	,,
Turner, W.	46	50	65	35	50	32	10	288	,,
Caffrey, H.	—	45	65	—	—	10	—	120	400
Fogarty, W. ..	37	—	—	—	—	—	—	37	100

SHEPPARTON.

Student's Name.	Lee.	Hawk-ins.	Haile.	Adcock	Archer.	Meek-ing.	Garns-worthy.	Total.	Maximum Number of Marks obtainable.
Crooks, A. S. ..	91	94	100	93	100	98	98	674	700
Hassett, P.	83	70	90	75	95	100	85	598	,,
Pither, J.	64	60	90	90	80	100	95	579	,,
Alexander, R. ..	61	50	98	91	80	91	85	556	,,
Cavanagh, J. ..	74	50	95	65	85	98	83	550	,,
Grace, J.	59	55	70	55	90	98	93	520	,,
Lamrock, S. ..	60	65	85	65	95	71	77	518	,,
Cronk, W.	56	17	80	78	80	94	82	487	,,
Clark, T.	66	35	95	60	75	60	75	466	,
Coldwell, J. ..	48	41	90	70	70	61	67	447	,,
Coldwell, Ern. ..	49	43	60	70	80	84	58	444	,,
Coldwell, Edw. ..	43	40	95	40	55	88	67	438	,,
Morris, A. E. ..	40	70	85	70	75	26	71	437	,,
Prideaux, H. ..	55	25	75	65	75	38	70	406	,,
Brensing, O. ..	55	15	80	35	60	65	60	370	,,
Sharp, T.	48	35	60	30	65	78	52	368	,,
Whitehead, J. ..	42	20	80	10	60	67	43	322	,,
Trewin, H.	43	10	100	15	60	32	47	307	,,
Morrris, L.	30	22	75	35	70	22	48	302	,,
Gibbs, W.	20	17	70	65	50	10	48	270	,,
Lamrock, P. ..	27	12	50	10	30	56	31	216	,,
Glover, J.	15	10	50	35	55	10	27	202	,,
Gribben, E. ..	32	—	—	—	—	—	—	32	100

GEELONG.

Student's Name.	Lee.	Hawkins.	Haile.	Adcock	Archer.	Meeking.	Osborn.	Total.	Maximum Number of Marks obtainable.
Stewart, T. ..	86	85	100	100	86	100	97	654	700
Farrer, J.	86	95	100	90	100	83	98	652	,,
Cother, A.	77	80	98	55	65	78	52	505	,,
McDonald, Ron. ..	60	70	92	55	65	69	73	484	,,
Fogarty, J.	62	30	90	55	70	88	80	475	,,
Pagan, W.	72	60	98	78	65	29	64	446	,,
Lynch, E.	68	50	90	60	70	43	71	452	,,
Wadelton, G. ..	72	20	95	70	82	35	67	441	,,
Honey, G.	50	65	95	60	65	48	55	438	,,
McDonald, R. ..	58	20	70	55	60	85	72	420	,,
O'Brien, Jas. ..	77	60	85	35	65	—	80	402	600
McDonald, D. M. ..	66	55	90	50	73	7	42	383	700
Hawkesworth, S. ..	51	50	90	65	60	13	40	369	,,
Ritchie, F.	50	80	95	50	30	27	15	347	,,
O'Brien, J. A. ...	54	55	60	35	35	57	48	344	,,
Churches, H. ..	62	10	50	75	65	10	63	335	,,
O'Brien, Jno. V. ..	38	15	80	35	55	45	58	326	,,
Smith, A.	62	15	50	60	60	7	36	290	,,
Ash, C.	58	15	60	60	30	20	46	289	,,
McDonald, A. ..	28	20	75	60	55	—	—	238	500
Nicholson, W. ..	72	—	—	—	—	—	—	72	100
Tadgell, C.	68	—	—	—	—	—	—	68	,,
Craike, W.	50	—	—	—	—	—	—	50	,,

KYNETON.

Student's Name.	Lee.	Hawkins.	Haile.	Adcock	Archer.	Meeking.	Trend.	Total.	Maximum Number of Marks obtainable.
Barker, W. ..	62	25	95	91	90	70	80	513	700
Young, H.	70	30	85	96	80	57	87	505	,,
Maxwell, J. ..	63	66	80	70	65	50	65	460	,,
Pavey, G.	52	65	98	60	70	38	77	460	,,
Moorhead, H. ..	46	40	88	40	85	40	78	417	,,
Smith, D.	47	22	60	65	60	25	74	353	,,
O'Connor, J. ..	48	25	50	30	80	20	60	313	,,
Young, C.	27	22	60	50	60	26	35	280	,,
Rodger, W. ..	—	30	—	45	70	45	41	231	500
Argyle, E.	44	33	—	—	84	20	—	181	400
Sturrock, Miss ..	52	25	90	—	—	—	—	167	300
Young, J. J. ..	27	22	100	—	—	—	—	149	,,
Hall, L.	44	-	—	—	—	—	—	44	100

It is interesting, for the purposes of comparison, to know what percentage of marks was gained by each centre in each subject. It is by means of these comparisons that a correct estimate of the value of the examinations can be arrived at.

CENTRE.	Agricultural Subjects, &c.	Poultry, &c.	Sheep, &c.	Agricultural Botany, &c.	Dairying.	Insect Pests and Plant Diseases.	Chemistry.
	Lee.	Hawkins.	Haile.	Adcock.	Archer.	Cock and Meeking.	Osborn, Robertson, Garnsworthy, Trend
Boort ..	54·8	48 5	93·0	58·5	66·2	46 6	56·8
Warrn'mbool	44·8	45·0	82·0	71 6	64·2	36·0	52·4
Maffra ..	50·7	60·0	72·0	63·2	68·4	39·6	58·4
Shepparton	50·9	38·9	85 9	55·5	72 0	66·0	66·4
Geelong ..	59 8	47·5	83·1	60·1	62 8	46·8	60·8
Kyneton ..	48·6	33·7	80·6	60·7	74 4	39 1	66·4

THE UTILITY OF OUR VICTORIAN FORESTS.

By A. Tatham, Esq.

It is well within the memory of residents of Victoria, that with the exception of a few grassy plains, the whole of the State was at one time covered with forest, which consisted of trees of largest size where soil and climate favoured, and dense, though stunted scrub in the more arid regions. These reproduced themselves, and each year saw a stronger growth, that in time would probably have even covered the grassy plains. Man, in the shape of the aboriginal, did little damage to the forest, his instincts not tending to settlement or agriculture. But with the advent of the white man began that interference with nature that has brought the State of Victoria down to its present state of limited forest areas. The time has long since arrived when steps ought to be taken to prevent a further reduction of those areas, or in a few years it will be necessary to re-plant, as is happening now in South Africa, at best a costly task.

As long as Victoria held large areas of forest, their produce was considered nature's free gift, even a waste and cumbersome produce; men took it, destroyed and wasted it. The produce of centuries was destroyed utterly in places, in less than a quarter of a century. Soon a cry will go up, and is doing so to-day in parts: "Give us some forests." Hence Forest Utilization, being the oldest branch of Forestry, cannot be too urgently brought before the public.

As time has progressed and population increased, more land was required for agricultural and pastoral purposes, and this was taken from forest areas; reckless cutting and burning has destroyed more forests, and to-day signs are not wanting to show that the remaining woodlands—except at isolated and unexploitable spots—cannot continue to produce all we require. This gives rise to another branch of Forestry—Forest Protection.

Forests are of great economic value both to man and nature. To man, chiefly through their produce; to nature, by the influence they exercise on climate, moisture, stability of soil, and the healthiness of the country.

To a State the forests represent a valuable asset if properly managed—First, by the produce they yield; second, by the capital they represent; third, by the work they provide.

Forest Produce.

Wood, the chief produce of forests, is universally used, viz.: shipbuilding, machinery, industries, agriculture, furniture, etc. Iron now competes with timber and coal with wood fuel, but, nevertheless, wood is still absolutely necessary, and likely to remain so. Take, for

instance, the comparatively recent demand for wood paper pulp —thousands of trees are annually converted into paper. Germany uses in this way 40,000,000 cubic feet per annum, and she is not the only country doing so. Another industry, where wood has taken the place of stone, is in road construction. The State of Victoria may not participate in the paper pulp industry, but she can in wood paving blocks. Mines must have timber and firewood, so that as far as the State is concerned the demand for her chief forest produce is likely to be large, and with little chance of decreasing.

Next to wood, as a forest produce minor products often take a not inconsiderable position. All produce other than wood and firewood is included under minor forest produce. This term covers a variety of articles, bark for tanning, bark for dye stuffs, turpentine, resin, gum, fruit, seeds, fibres, grass, moss, peat, honey, wax, and numerous other substances not found in Victorian forests. The wattle bark industry of the State in some forests far exceeds in revenue any other. It is estimated that minor forest produce is imported into England to the value of £8,000,000 annually.

Capital Represented by a Forest.

The capital invested, so to speak, in a forest is represented by the soil and the products growing on it. If the forest is worked irregularly the capital must fluctuate; but if a proper system is adopted and the work systematically conducted, an equal annual return is assured, and the capital remains unchanged. The soil represents the fixed capital, and the growing stock the shifting capital in forestry. The proportion of the one to the other is influenced by the treatment the forest gets. In a coppice forest, which we call scrub country, the fixed or soil capital is as a rule greater than the shifting; but in high forest, where the trees are left for milling purposes, the shifting capital far exceeds the fixed. Let us take as an example an area of 100 acres. This is divided into 100 one acre lots; in No. 1 lot the seedlings are one year old, in No. 2 they are two years old, and so on up to No. 100 lot, where they are 100 years old. This lot is cut over, and as is the case with Victorian forests, natural reproduction will at once follow. There will then be 99 lots still left stocked with trees from one to 99 years old, the following year No. 99 lot will be 100 years old and will be cut over, and so on each succeeding year till the first felled lot is again arrived at, at the end of 100 years, when the same order of things is gone through, *ad infinitum*. Without this system of age gradations it would be impossible to obtain a regular yield of trees 100 years old. The above system of forestry is known as the Rotation System, and is undoubtedly the system most suitable to Victoria.

The above example clearly proves that the shifting capital increases with the length of rotation or full maturity of the growing stock, that the growing stock is at first smaller than the value of the land, about equal to it when half grown, and exceeds it when fully matured.

Considerations Affecting the Investment of Capital in Forestry.

Forests do not require artificial manuring, they require less mineral matter from the soil than field crops, and they return to the soil in the shape of leaves more substance than field crops. They also protect the soil by their crowns, and naturally conserve and create a thick layer of humus, hence forests can be grown with success on poorer ground than field crops. Therefore, the inferior ground is left for forests, whilst the better is allotted to crops. Forests are subject to many dangers; storms, fires, human agency, animals, and insect pests. Field crops are only exposed to these dangers for a short period, say one or two years, and from their limited area are more easily protected, and if destroyed can be replaced in a year. Not so a forest. It is exposed for a long period of years, and its large area interferes with its protection. A fire may destroy the whole of the growing stock, that has taken 20 to 30 years to grow. Storms will uproot and break off the crowns of trees, and cases have occurred in Victoria clearly showing how disastrous a storm can be. Insects can and are doing terrible damage in some of the existing State forests, both as borers and leaf destroyers.

Mistakes made in the cultivation of field crops can be rectified in a year or so, but in forestry a mistake in working or in planting the wrong species is often not detected for years. From this it can be seen that losses are greater from want of care in forestry than in field crops.

Forest produce is bulky, far more so than field crops, therefore forests must be preserved as near a market as possible, and their produce consumed within a limited distance. Water transport is the old cheap one, but Victoria possesses no great facilities in this way, hence it is absolutely necessary to secure forests as near railways as possible. Even now the cost of transport on forest produce is becoming a serious tax on the consumer. The capital invested in a forest stands great danger of being trenched on, far more so than on a farm or sheep station. A farmer may overcrop and reduce the value of his land, a station may overstock, but both can be easily detected and rectified; whereas, seeing the capital in a forest is represented by the growing stock, and from this the annual return is looked for, an ignorant forester could easily consume much of his capital by trying to show large returns, without being detected or even without knowing it himself, doing thereby in two or three years damage that it would take ten or more years to put right, let alone disorganising the whole of the system of working the forest. Such mistakes are common in forests, and Victoria has had her full share.

Forests are all over the world burdened with rights or servitudes. In Victoria the only recognised right is that belonging to the miner, and without doubt it is the severest a forest has to contend with. In most countries forest rights have existed for ages. In India, for instance, villages existing near forests have the right to collect produce and

graze cattle within certain areas; in Europe and in ancient times even in England, a right to hunt deer and wild boars was acknowledged. These rights or servitudes may attach to one individual or a house even, in such a case it became extinct with the death of the individual. Rights interfere with and depreciate the value of the property. Let us take the case of a "miner's right." The miner is at liberty to enter any forest, peg out a claim, sink a shaft, or series of shafts, fell all the timber on his area, and help himself largely outside it. He may change his site as often as it pleases him, his system of cutting timber is wasteful and outrageous, his carelessness with fire often leads to serious damage to the forest. His workings, as a rule, cover large areas, and run in lines, thereby cutting the forest up into a series of isolated blocks, impossible to traverse except on foot, making the exploitation of the forests a most expensive item, and all this, for a matter of a few shillings. For ten shillings a miner can easily, even unthinkingly do damage equal to twenty pounds.

Labour Required in Forestry.

Forests give labour in a number of ways.

First.—General control and work done in forests.

Second.—Transport of produce.

Third.—Industries dependent on forests for their material.

General Control.—At present the system of working the Victorian forests does not give much labour, but as a proper system is gradually brought in, the amount of labour required will clearly prove how useful a forest is to a State. The amount of labour required is governed by the system of management. It would not be beyond the bounds of possibility to say that if put under a proper system and thoroughly worked, the State forests would require two days' work per acre per annum, but such a state of things will take a long time to arrive at. At present the forests employ too few labourers, and are suffering accordingly.

Transport of Produce.—This branch of forestry gives a fair amount of work in Victoria. The demand for mining timber and firewood gives work to a number of carters, who would otherwise be idle. It also gives work to farmers living near the forests, during the slack season of the year.

Forest Industries.—The produce of forests gives work to millions of persons all over the world. The working up of the raw material into marketable products, and the amount of labour employed, could not be correctly calculated—seeing that the scope of work covers from ship, bridge, and house building down to toys, pencils, and matches.

Influences of Forests on Climate and Soil.

Temperature of the Air.—There are ancient records to clearly prove that forests were in ages past considered to affect the climate,

the rainfall, regulation of moisture, and the healthiness of countries. In modern times observations on the most accurate basis have been undertaken, in Europe, America, and India, to prove effects of forests on temperature and rainfall. The system adopted was to have an observation station situated in the forest under the shade of high trees; another station outside the forest, in the open, and at some distance from it. The readings were taken two and three times a day, and in two cases, every hour. The results proved, that on the whole, the forests slightly reduced the temperature of the air. It also proved that the difference in temperature was greatest in summer, least in winter, and about equal in spring and autumn, also that the temperature of the forest was higher during the night, and lower during the day, than on open ground, this last difference was most pronounced during summer.

Temperature of the Soil.—The temperature of the soil is governed by that of the air, and the conclusions arrived at were, that the mean annual temperature was nearly the same from 1 foot to 4 feet down, and that the mean annual temperature of the forest soil is decidedly lower than that of soil in the open, in summer by nearly 7 degrees, but very little in winter. The effect differs also in different species of forest, an evergreen forest showing a greater reduction in temperature than a deciduous. From the foregoing we may conclude that the climate in forest countries is more equable than in open countries, and the temperature of soil and air in forests is slightly lower than in open countries, while vegetation starts later in forests than in the open.

Hot countries may benefit by forests, but those countries removed from the equator may suffer where the temperature is already lower than is good for field crops. Plants grown in the open, suffer more from drought, and early and late frosts than those grown in forests.

The Moisture of Air.—Science teaches us that air can only hold a certain quantity of vapour—this increases and decreases with the temperature. When more than the maximum is reached, it becomes fluid. The vast sheets of water that cover the earth's surface govern, to a great extent, the humidity of the air; still the forest vegetation must exercise an effect, owing to the reduction of temperature within its sphere of influence. Careful experiments go to show that the mean annual excess of humidity in forests ranged from 8 to 10 per cent, and it is a known fact that a dry current of air passing through a forest becomes moist; so much so, that precipitations may be caused. Dew is also formed in greater quantities near a forest than away from it.

Rainfall.—The much discussed question as to how far forest growth can or does influence rainfall remains still unsolved. It is an undisputed fact that forests can affect precipitations, since forest-air is moister than air in the open, and the trees do affect the movement of air. But rainfall depends chiefly on other more powerful agencies, compared to which, the forests powers are but small. Elevation

above the sea is the most powerful agent at work in causing rain; when elevation combined with forests exists, the result is undoubtedly in favour of a heavy rainfall. It has often been admitted that forests situated on plains do not affect the rainfall. Observations are still being recorded, but so far no more reliable data are forthcoming.

Feeding of Springs.—Not unusual sights in Victoria are the enormous gullies that are seen forming in different parts of the State, where no gully existed before. In some instances these have ruined prosperous properties, burying whole paddocks in worthless silt and gravel. In other places the ground, if sloping at all, has had every particle of top soil washed off it, and either hard clay is left, or an impenetrable mixture of gravel and clay. Rain falling on these areas runs off at once, causing a rapid rise in the level of streams and often floods. No moisture can penetrate the ground, and instead of the rises and hills absorbing the moisture and allowing it to percolate slowly through the earth, it all pours off in a short space of time, causing devastation and often as not landslips. The cause of all this trouble is easy to see—denudation of the forests. Of the amount of rain falling on a forest it is estimated one-fourth is intercepted in the crowns of the trees, and the balance falls to the ground, where it is in turn soaked up by the humus, which has the property of absorbing a great quantity of water and retaining it for some time. Most of this water soaks eventually into the ground, and goes to feed springs. That unabsorbed finds its way to the nearest stream, and as its progress is retarded, it naturally keeps the stream running longer than if the water rushed down in a flood. From this it may be gathered that it is absolutely necessary to ensure a steady water supply, that a large area of forest should be retained on a river catchment area, and in fact on all hills. Again, to protect the soil, it is necessary to retain a well-preserved forest on the slopes, for where these have been water-worn, re-afforesting is a difficult matter. In some places the process of re-planting has only been possible after erecting dams and walls to retain the little soil that remained, until such time as the young trees were strong enough to do it for themselves. Forests also protect the soil on low lands, and it is familiar to most sea-side residents in Victoria how enormously the shifting sands on the coast are intruding since cattle and other agencies have destroyed the grass and shrubs. In France, in Algiers, and in central India, vast areas of drifting sand have been checked by planting forest trees. Forests also prevent disastrous air currents. Cyclonic disturbances will often lay large tracts of country bare. These do much damage to forests, but it is often noticed that after striking a forest, the force of the cyclone is checked, and in cases of severe whirlwinds, the air-current is completely broken up.

Animal Life in Forests.

The importance of forests as reserves for animal and bird-life should not be overlooked. It is unfortunate that pests in Victoria, such as the rabbit, find a sure and safe retreat in the forests. But

on the other hand, useful birds also find in them a sanctuary. Around the large towns bird-life is being fast destroyed by persons who possess a cheap gun. This wanton destruction is extending to the country, and already some forest areas are suffering severely from insect pests, and a dearth of bird-life. The wholesale destruction of trees also is tending to lessen the supply of these only true insect destroyers.

Should our Forests be Protected?

In conclusion, the question Victoria has to ask herself is—Is it a wise policy to protect our forests or not?

If the State finds she can import her necessary timber, and if she finds the direct beneficial effects of forests as shown in the foregoing are not necessary, then she need not trouble. But if she finds the timber to meet her requirements cannot be imported except at enormous cost, and that climatic and mechanical effects are endangered, then it is her duty to protect her forests and utilise them to the fullest extent.

TAKE-ALL AND WHITE-HEADS IN WHEAT.

(Ophi bolus graminis, Sacc.)

By D. McAlpine.

After a long and disastrous drought, the present season has been remarkable for a luxuriant growth which has seldom if ever been equalled, and not only does this apply to fodder and forage crops, but also to the wheat-fields, with their abundant harvest. The favourable season, however, is not without its drawbacks, for it has also encouraged the growth of various fungus parasites, which have tended in some degree to diminish the bumper yield which was naturally expected.

The rust in some instances did considerable damage, but generally speaking, the crops were too far forward to suffer much from that cause when it appeared. It was mostly confined to the flag, and did not develop to any great extent on the straw, so that the grain was not affected as much as was at first feared. There was a considerable amount of flag smut too in some crops, and they suffered accordingly; but this disease was not very widespread. Over a large area, however, there were strips and patches in which the wheat-plants seemed to have been arrested in their growth, and in these there were only miserable stunted specimens, dying off at various stages while still in the blade. Such patches have long been known to farmers as take-all, which is a convenient and expressive term to indicate that owing to some cause or other, nothing is left but the withered remains of dead plants. Even in driving past the wheat-fields these gaps in the crop are easily seen, and often fairly numerous. Then as the season advanced, and the ears began to appear, it was found that wheat-plants which promised well, and had fully formed heads, did not develop grain, or if they did, it was shrivelled and almost valueless. The plants were not only dead at the top, but also from the root upward, and the whole had a bleached appearance, so that the name of white-heads has been given to this disease, from the striking appearance of the ears as if prematurely ripe. A solitary plant might be seen in the midst of others, with well-filled ears, or there might be strips and patches of them, just as in the case of take-all.

Although these two diseases have long been known as destructive to our wheat-crops, and considerably depreciating the yield, still their true nature was not understood, and they puzzled not only the farmer, but even those who had devoted some time to their investigation. Their prevalance this season, and the favourable conditions for their development have enabled me to determine the immediate cause, and it will now be my object to show that take-all and white-heads are both different stages of a diseased condition of the plant, caused by one and the same fungus, which occurs at the base of the stem and on the roots.

G. H. Robinson, Photo.

WHEAT PLANTS ATTACKED BY THE TAKE-ALL FUNGUS (NAT. SIZE)

(*Ophiobolus graminis, Sacc.*)

Symptoms of Disease.

It is necessary at the outset to understand clearly what we mean by take-all, for the vagueness of the term, or rather its comprehensiveness, might lead to almost anything being included under it which killed the plants at a comparatively early age. While investigating take-all this season, I have met with patches in the crop, in which a prevalent weed had grown so thickly as to smother completely the young wheat-plants. That this is often mistaken for take-all is shown by the fact that quite a number of weeds have been regarded and given as the cause of it. In other cases, there were patches where the land was boggy, and the root-rot which brought about the death of the plants was evidently due to this. Again, where trees have been burnt upon the ground, the crop on these patches may also go off. Excess of potash on burnt soil may possibly favour the fungus and likewise be injurious to the wheat, and such a combination would soon lead to the death of the plants. Excess of nitrogenous mature too is unfavourable, and where old sheep camps have been, there the plants may die out.

But the true take-all, that which is regarded by the observant farmer as such, had invariably a special fungus at the butt of the stem or on the roots, either in its vegetative or reproductive stage, so that the term has now a definite meaning, and applies to wheat-plants which have succumbed to the attacks of this particular fungus. The fungus origin of the disease at once explains the various symptoms observed.

The general symptoms have already been given, but if the disease is followed from its earliest appearance, it will be seen that plants succumb at various stages of growth, according to the time and severity of the attack, the nature of the season, and the condition of the plants themselves.

In some spots or patches where the fungus is very prevalent, and the young plants are attacked early, the disease may appear before the formation of the stalk. They assume a sickly appearance, having lost their dark-green colour, their leaves turn yellow, and soon they shrivel up and die. Again, the attack may be later, or the plants are better able to withstand the fungus, and so they linger on longer, but ultimately die. The fungus spreads from a centre, attacking the plants in its vicinity, and so dead patches occur here and there throughout the crop, to which the name of take-all is given. But it was quite common this season for the wheat-plant to produce its ears and look as if it were going to fill them, but suddenly as it were, they became bleached as if prematurely ripe, and the plant died from the root upwards. Every gradation has been met with from the take-all in which the plants died young to the white-heads in which the ears consisted of mere empty husks, or if the grain formed, it soon shrivelled and did not come to maturity. The farmer noticed the two seemingly distinct stages, and named them accordingly, but generally failed to see that the wheat-plants were dying off at different stages in various portions of the crop. In some soils, especially rather firm sandy loams, the early

destruction of the plants is hardly so noticeable as on loose friable soils, and the plants seem better able to withstand the fungus for a time at least, and when they do succumb, it is only after the ears have begun to appear.

These are the symptoms which readily strike the casual observer; but if the dead or dying plants are closely examined at the root, they will be found more or less blackened at the butt, hence the name given to this disease in France is "Foot-rot" or "Black-leg." And if such plants are pulled, it will be found that the roots break off short, leaving only a short, densely hairy and swollen portion attached to the stem. It often occurred that new roots had been given off by the stem above the diseased portion, and they were sometimes able to prolong the life of the plant, but sooner or later they became unequal to the task of keeping up the supply of food, and so death ensued.—(See Figs. 1 and 2).

Conditions under which the Disease Occurs.

There is a large body of evidence on this point, only we must be sure that it is the disease caused by a fungus with which we are dealing, and not one due to a hollow seed-bed or water-logging, or the plants being overrun with weeds. Not only have numerous specimens been examined, sent from Numurkah in the East to Nhill in the West, from Quambatook in the North to Ballarat in the South, and from South Australia as well, but my assistant and myself have driven over large stretches of country in order to observe at first hand the conditions under which the disease occurred. Over a limited area one kind of soil is seen to be worse affected than another, one kind of wheat more susceptible than another, but when observations are extended, these distinctions often disappear.

In the Donald district, visited about the middle of November, and which comprises some of the finest farming land in the State, I found that while the wheat crops generally were as heavy as ever produced in that part, yet there were a number of take-all patches and white-heads, which would considerably reduce the expected yield. A number of varieties were grown, but they were all more or less affected. One farmer pointed out Dart's Imperial as comparatively free, while another considered this variety as the worst. Queen's Jubilee was likewise noted as very bad, while in another case it was quite free, so that none of the varieties grown here seemed to be exempt. Then there are two kinds of soil in the district, known as the red and the black. The red land is best in a dry season, for it is firm, and retains the moisture, while the black land under the same conditions cracks and soon becomes loose and dry. The black land is very rich, and requires more moisture, and with good rains it becomes firm, the moisture going deep down, and causing the crop to come up well. This season the rainfall was above the average, being 17·97 inches to November 13th, as against an annual average of 16·17 inches, and the black land produced magnificent crops, but in both kinds of soil the disease was found.

There was a splendid crop of wheat growing on black soil, which had been fallowed early (June), sown about the beginning of April with 27 lbs. of seed, and a dressing added of 15 lbs. concentrated superphospate to the acre. It had been fed down with sheep for six weeks, and while the main crop was a splendid sample, and almost ripe, a strip had to be cut early on account of white-heads. There was no evident difference in the land where the white-heads occurred, but one farmer remarked that it usually appeared on the best land in a paddock.

South Australia has long suffered from this disease, and I am indebted to Mr. Summers of the Agricultural Department, Adelaide, for valuable information and specimens. With reference to some plants sent, which showed the fungus in profusion, he wrote:—"Most of the plants came from some of my experimental plots. I noticed far more where potash only was applied, than where either phosphates only or phosphate and potash was the dressing. I think, however, this was only due to the fact that the former crop was much thinner, consequently the dead plants were more prominent."

The opinion of farmers is most conflicting in connection with the appearance of take-all Some say that it is worse in wet seasons, others, in dry; that it is not so bad in manured as in unmanured land; others, that it is just as bad; and still others, that it may occur on a slope or on flat land. It is generally conceded that in new ground it only appears in small patches. No wonder that the South Australian Commission in reporting on take-all in 1868, said:—"Its movements being so little reducible to rule, experience and observation are at fault in endeavouring to explain it, and hence conflicting ideas. This difference perplexes the inquiry, whilst the rapid spread of the pest and the fear that it will every year encroach upon wider tracts of country, render close observation and study a duty of the utmost importance." Now that take-all is known to be a specific disease caused by a specific organism, much of the perplexity vanishes, and our efforts in getting rid of it are directed towards a certain definite end.

The examination of hundreds of specimens this season from different wheat-growing districts has shown that in the best crops and the worst crops alike, the disease appears. It is found in fallowed and manured land as well as in unmanured, and where constant cropping has been resorted to. It has been met with also in newly-ploughed land and in new land fallowed. The crops generally are heavy and healthy, and although the disease seemed to attack manured and unmanured alike, still in those cases where wheat had been continuously grown, it appeared to be more generally distributed.

The fungus being in the soil, and the spores germinating readily in moisture, as has been experimentally proved, wherever the seedling wheat plant came within its sphere of influence there would the disease appear. And in land continuously cropped with wheat, the fungus had spread and multiplied from season to season, so that the land had become more or less impregnated with it. Another cause

of its spread in the northern districts of Victoria lies in the vast amount of dust that has been blown over large areas. It has to be seen to be realised how the blown dust accumulates in such quantities, wherever it is intercepted, as to bury fences out of sight, and it was no unusual thing during my visit in November to drive over buried fences. This is no doubt a fruitful source for spreading the fungus, and it may appear in any class of soil under those conditions. There is no difficulty then in accounting for wheat-plants becoming infected, and since the fungus spreads from a centre, the disease generally occurs in patches, or it may be on isolated plants, which, in after years, would form the centres of take-all patches. Then according to the virulence of the attack and the condition of the plant, the latter succumbs at an early stage of its growth, or it may be able to grow in spite of the fungus and fully form its ears without being able to produce grain, or in some exceptional cases it may even proceed to the formation of grain. But ultimately the root and base of stem being attacked, the plant dies before reaching its full development, and thus there may arise the take-all patches when the young plants have been overcome by the fungus, or white-heads, when the plants have had sufficient constitutional vigour to resist the fungus for a more lengthened period. Sooner or later, however, the plants attacked are destroyed, and then the fungus proceeds to prepare for its next campaign by producing its reproductive bodies on the dead roots in the soil, or on the butts of the stems just above the soil.

Various Causes Assigned.

It was only to be expected that such a widespread and destructive disease should attract attention, and numerous theories were advanced to account for it. In the report of the South Australian Commission (1) already referred to, a summary is given of the views then held, and they fairly represent the conflicting opinions which still prevail. "It is said to result from an exhausted soil—from the presence of too much salt in the soil—from the deficiency of some constituent element essential to the maturing of cereal crops. It is declared to be want of drainage, and it is said to be want of manure. It is affirmed to be caused by a vegetable fungus, and to be a disease analagous to the potato disease. It is also said to be the result of insect ravages. Scarcely any two witnesses agree on this point, whether farmers or chemists." It was also believed to be in the seed, and there is thus a fairly large number of explanations to choose from.

First, it was thought to be in the seed, but this view was disproved by the fact that the same seed grew perfect plants alongside of deseased patches, and even in these patches the seed germinated properly at first. The disease was evidently due to something outside the seed.

Second, it was commonly believed to be due to the want of some constituent or constituents in the soil, necessary to the healthy growth of the wheat-plant; in fact that it was a poverty disease. The occurrence of the disease in patches seemed to militate against this

view, although it was contended that the soil in large paddocks is very variable, and that the deficiences occurred where the take-all patches existed. This is very like begging the question, and goes on the assumption that no manure was applied to make up for these supposed deficiencies. But during this season at least, the disease appeared where phosphatic manures had been applied, and the seed had been drilled in, as well as where there was no manure.

Third, nematode worms are often found associated with the disease, and the assumption was that they were a contributing cause, but it is seen on close investigation, that while these eelworms are undoubtedly present, they only appear in small numbers when decay has already been set up by the fungus, and are to be regarded as an accompaniment rather than as a cause of the disease. The appearance presented by the attacked plants is suggestive of this agency, and Mr. Smith, of Horsham, writing to me on the subject, remarks—" Whether they have anything to do with take-all I cannot say, but the roots of plants affected all appear to be eaten off short, say about two inches from the stems." This has already been referred to as a symptom of the disease, and is the result of the action of the fungus which causes the decay of the roots, so that when the plants are pulled up, if the ground is at all firm, the roots break off short.

Fourth, farmers often point to certain weeds as being the cause of take-all, and although quite a number have been thus regarded, a very common one is the so-called hunger plant *(Silene gallica.)* This is a case of association and nothing more, and since such plants are often found accompanying the disease, they are hastily set down as the cause of it. The addition of manure, such as superphosphate, will enable the wheat-plant to outstrip and overcome the weeds, though in some cases, no doubt, the weeds are merely there because the death of the wheat-plants gave them room to grow.

The ground is now clear for the consideration of the cause which explains all the facts, and shows the various theories in their proper light.

Disease Caused by a Fungus.

Before intelligent measures can be taken to cope with any disease, it is necessary to know something of the cause or causes which produce it, and then one is in a position to devise means whereby the cause may be removed, or if that is not practicable, to minimize its injurious action as much as possible. In some instances the farmer in the course of his practice, without any knowledge of the real cause, may hit upon something which counteracts its effects, and as we shall see this has actually been done in the present case, but nevertheless, it remains true that a knowledge of causes and the effects they produce, puts us in the way of controlling them intelligently and effectively, and without long and laborious and often fruitless groping in the dark.

It is not sufficient however to find a fungus associated with a disease, in order to be sure that it is the cause of the mischief, for it may be there simply as a scavenger to prey upon the decayed or

decaying material which has otherwise been prepared for it. In fact there are many such fungi known which are therefore called *saprophytes,* and in order to settle conclusively that a fungus is a *parasite,* that it preys upon the living plant and causes its decay, there must be infection experiments carried out, and the disease produced in the plant through the agency of the fungus supposed to be concerned.

With this object in view, a series of infection experiments was designed and carried out by my assistant, Mr. Robinson. As each batch of specimens was received, they were carefully examined, and the stubble from a proportion of them was placed in sand in ordinary flower-pots, and clean, healthy wheat of the previous year sown with it. After eighteen days, when the wheat-plants were about six inches high, characteristic brownish spots were observed on the young stems. Microscopical examination showed the presence in abundance of the young mycelium of the *Ophiobolus** not only in the sheath and stem, but also sometimes in the roots, where the same discoloration was often observed. After six weeks many of the plants were dead and showed in abundance mycelium identical with that in Figs. 3, 5, 6, 7 and 8. Extended experiments and observations are needed here, and will take some time to thoroughly carry out, though it may be said that the work has proceeded so far now that no difficulty is anticipated in being able to raise take-all plants with the fruit of the fungus *Ophiobolus* upon them from these pots. The plants in the check pots sown in uninfected sand, remained perfectly healthy in appearance.

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* *Ophiobolus graminis, Sacc.*

Perithecia gregarious or scattered, slightly erumpent or immersed, smooth and covered with numerous septate branching hyphae, globose, with straight, oblique or slightly curved beak, membranaceous to carbonaceous, very large, body 200—400 microns, † and neck up to 200 microns long.

Asci straight or slightly curved, elongated clavate, rounded at apex, subsessile, 8-spored, 90–130 × 11–13 microns; paraphyses slender, septate, attenuated towards apex, longer than asci.

Sporidia sub-hyaline, fasciculate, slightly curved, usually blunt at one end and acute at the other, slender, at first 3–5 septate, often at length 8–9 septate and prominently guttulate, 70–105 × 3 microns.

At base of stem and on roots of Wheat.

Hendersonia graminis, n.sp.

Perithecia black, punctiform, erumpent, globose with projecting neck and covered with fuliginous, simple, septate, hyphae, more particularly on neck, dark-brown by transmitted light, membranaceous to carbonaceous, of parenchymatous texture, about 240–360 microns diam and neck up to 200 microns long, and occasionally branching.

Sporules dark-olivaceous in mass, pale olivaceous individually, straight or slightly curved, fusiform and acute at both ends, or blunt at one end, 7-septate when mature, not constricted at septa, with granular contents, 32–38 × 4–5 microns, very commonly 35 microns long.

At base of stem and on roots of Wheat.

The perithecium is rather variable in its nature. It may or may not be provided with a beak, and it may be covered all over with projecting hyphae or only partially, sometimes on the neck and sometimes only at the base.

This appears to be the pycnidial stage of *Ophiobolus graminis,* Sacc., and although the perithecium is often provided with a beak, still it is also often without, and I have accordingly retained it in the genus *Hendersonia* In *O. herpotrichus* (Fr.) Sacc, closely allied to this species there is also a pycnidial stage, *Hendersonia herpotricha* Sacc., in which the spores are cylindrical, 8-septate and 36 × 6 microns.

† Micron is approximately $\frac{1}{25000}$ of an inch.

Mangin (19) in France, had already sown the spores of this fungus upon young wheat-plants, and infected them successfully as early as 1899.

Nature of the Fungus.

Having settled the fungus origin of the disease, the next step is to study the fungus itself, so that we may know how it lives and grows and multiplies, and knowing something of its nature to fight it with suitable weapons. I have no intention of giving a detailed account of it here, but just sufficient to enable us to understand the reason for the treatment recommended, aided by the illustrations prepared from photo-micrographs made by my assistant.

Every fungus consists of a vegetative portion, which is usually composed of innumerable, interlacing, fine threads, more or less closely knit together, and collectively known as mycelium or spawn, and a reproductive portion for propagating the species. The vegetative portion, or mycelium, as it is called, may exist in three or four different forms. First, there is the kind consisting of numerous dark-brown, somewhat interlacing filaments, spreading upwards from the root, as shewn in Figs. 3 and 7, magnified 200 times, and Fig. 8, magnified 400 times. Indications point to a spread of the fungus from one root to another by this mycelium, as long strands are often found piercing the roots and joined to the form shewn in Fig. 6 (× 200), which fills the cells of the roots and stem, causing the dark-brown or black appearance. Then there is what is termed the plate mycelium, seen in Fig. 5 (× 200), which occurs almost exclusively between the inner sheath and the stem, and which is found to be connected with the forms previously described. This plate mycelium is as a rule easily peeled off from the stem, and in fact when the plants are dry it naturally comes off in flakes, and very probably may serve to infect young plants the succeeding year. Then in Fig. 4 (× 200) is shewn what is really a modification of the form in Fig. 3, many light-brown strands being joined together to form a broad band, which passes upwards on the inside of the sheath. All these forms draw nourishment from the wheat-plant and appropriate it for the ultimate purpose of forming the fruiting portions or perithecia. The perithecia or spore-cases are flask-shaped bodies, of which the lower swollen part is immersed in the tissues of the wheat plant, and the neck, which may be straight, but is usually slightly curved, projects from the surface. (See Fig. 2 natural size, Figs. 9 and 10 magnified three times, Fig. 11 fifteen times, and Figs. 12 and 13 thirty times.) They are either scattered or in groups, and may occur on the roots or on the sheath. Inside each spore-case are numerous little sacs or asci (Fig. 14, × 400) each of which contains eight spores (Figs. 15 and 16, × 400) so that a single spore-case contains an immense number of spores. When the spore-cases are mature the little sacs are expelled one after another at the mouth, and the spores are set free in the presence of moisture.

The spores themselves are elongated slender bodies, divided into compartments by cross-partitions, as shewn in Figs. 15 and 16. They

germinate in water very readily when the temperature is favourable, and give rise to long germ-tubes or little sickle-shaped bodies. (Figs. 17 and 18, × 400). During November the spores germinate easily in water in from one to four days, either producing the sickle-shaped bodies directly or giving rise to a longer or shorter septate or non-septate germ-tube, which may or may not bear a rosette of these short, sickle-shaped bodies at the end. Mangin (17) observed the germination of these latter by sowing them in the young plantlets of wheat in a humid atmosphere. At the end of four days he found that they had put forth a germ-tube at one end, which crept along the surface of the root-hairs and soon pierced the membrane and entered the interior of the plant. In water to which certain mineral salts were added, such as 1 per cent. sulphate of ammonia and 1 per cent. phosphate of ammonia, germination did not take place.

Associated with the *Ophiobolus* another fungus was occasionally found, which usually produces its fructification a little higher up the stem, although it may be intermixed with it and even occur on the roots. The perithecia or spore-cases were very similar, but the contents were quite different. Instead of containing a number of little sacs, the spores were free, and a little darker in colour, and only about one-half or one-third the length of the others. When the ripe perithecia are placed in water, the spores escape, and are held together by a mucilaginous substance, which soon dissolves in the water. The spores germinate very rapidly when ripe, by putting forth from one or more of the joints, long and branching threads, which probably enter the young roots or root-hairs of the plant, and become parasitic. At first sight it might seem as if there were two distinct fungi concerned, but they are very probably, as in the case of allied species, only different stages of the one fungus. Whether this is so or not, the *Ophiobolus* or wheat-stem-killer was always present, and the other form only occasionally.

The Wheat-stem-killing Fungus in Australia.

The fully mature or reproductive state of this fungus was first found by me in December, 1900, on wheat sent from South Australia by the then General Secretary to the Agricultural Bureau, Mr. Molineux. In the accompanying letter he wrote:—"I am forwarding, under separate cover, samples of wheat affected in some way unknown to me. The farmer who grew it, states that a few plants here and there in the crop go off rather suddenly, the head colors, but there is no grain in it. Frost, hot winds, and poverty of the soil cannot be blamed. The crop was manured with a mixture of 60 lbs. mineral superphosphate, and 20 lbs. bone dust per acre. The trouble is worst in the heavier crops; those only light are comparatively free. On some adjoining farms the trouble appears on well-worked fallow and fresh ploughed land, on land manured with superphosphate or bone-dust, and land not manured." This is the disease known as white-heads, and the above description fairly represents the varied conditions under which it occurs. A brief account appeared in the

"Journal of Agriculture for South Australia" (22), and therein is the first record of this fungus for Australia.

But the fungus existed here on the wheat-plant about fifty years previously, having been known in South Australia since 1852, although its nature was not recognised. Mr. Ey, analytical chemist, in giving his evidence before the Commission in 1868, said :—"A plant taken from a diseased spot will be found black on the stem, from the roots to the first internode; and on pressing, a thin film of lichen or moss will come off. In this will be found a number of animalculae coiled up, apparently dead. I have not yet satisfied myself whether the eel or the lichen is the primary cause; but one of the two is take-all." He was right in this last conjecture, only his so-called moss or lichen was undoubtedly the plate mycelium stage of the true take-all fungus, but unfortunately he gave preference to the eel worm theory, and so the fungus was not further followed up.

It is also evident from a careful consideration of the drawings given by Dr. Carl Muecke (2), in his essay on take-all, published in 1870, that he observed within the stem of affected wheat-plants, the mycelial condition of the *Ophiobolus*, as some of these drawings are exactly similar to Fig. 6. Unfortunately, however, he did not recognise its true nature, as he refers to it as a "sort of lumber" within the cells, and confused the root-hairs, which are generally produced in abnormal numbers on diseased plants, with the mycelium of another fungus, a harmless saprophyte, called by Baron von Mueller, *Xenodochus cerealium*, and concluded that the disease was the result of starvation, the exhaustion of the supplies in the soil of certain necessary substances.

Tepper (9), in a thoughtful paper on *Take-all and its Remedies*, state that the disease "is nothing else than starvation of the crop," and naturally recommends manuring. Extended investigation, however, would have shown him that the dreaded disease may appear even when the necessary manures have been supplied to the crop.

Dr. Cobb (10), in 1892, came to the conclusion that take-all was caused by a fungus, and he considered it to be the common blackish-olive mould, which occurs generally on the dead or decaying portions of plants, but may also occur on the living. He, therefore, named *Cladosporium herbarum* Link, as the take-all fungus, but since this fungus is almost universally regarded as harmless, and has rarely been found on the diseased specimens sent to this branch during the past three seasons, this view cannot be regarded as substantiated. But the wheat-stem-killing fungus stands on a different footing. Not only has every take-all and white-head patch examined in the paddock this season, been found to be attacked by this fungus, as well as the numerous specimens sent from different districts, but the ultimate court of appeal has been referred to, and infection experiments have proved that the wheat-stem-killing fungus produces the disease known here as take-all and white-heads.

The Disease in other Countries.

The same disease occurs in other countries, but under different names, and this, as well as the fact that the reproductive state is only sparsely produced in some years, has prevented its earlier recognition here. Besides, elsewhere, it does not usually kill off the plants in the early stage, recognized as take-all by us, but after the ears are formed and the grain begins to develop.

In Britain, Smith (5), refers to a disease well-known to farmers under the name of straw blight. It commonly reveals its presence in midsummer, by the impoverished ears, but it sometimes occurs in spring, and then it kills off the plants. Only the mycelium or vegetative portion of the fungus has been found on and in the straw very close to the ground, but from its mode of occurrence and structure there is no doubt of its being the same disease. The losses range from one-half to one-fiftieth part of the crop, and perfect drainage is recommended to lessen its attacks.

It also occurs periodically in Italy, Belgium, Germany, and France, and has recently been discovered in America, and in some of these countries it has been closely investigated. In France, where it goes under the name of foot-rot, and has been known at least since 1878, Prillieux and Delacroix (7), have called attention to this disease as well known to agriculturists, and widely distributed, and show it to be caused by this parasitic fungus. At harvest-time they did not find the fungus forming its reproductive bodies, as often occurs with us, but later, and they recommend the destruction of those grasses on which this fungus is parasitic as well as on the wheat.

Mangin (19), has specially investigated this disease, and the fungus causing it, and succeeded in infecting young wheat-plants with the spores, thus proving it to be a parasite.

Schribaux (8), in the "Journal of Practical Agriculture," describes various experiments in connection with this disease carried out at the Seed-control Station, near Paris. He found that early varieties were chiefly attacked, and that some varieties had a high degree of resistance. He also carefully collected and burnt the rotting stubble attacked by the fungus, and not only was this of no avail, but next year the disease attacked the crops with greater severity than before. Experiments with various manures, such as superphosphate, chloride of potash, and dried blood, showed that they tended to check the fungus, and a dressing of Thomas phosphate with rolling, gave excellent results. He also tried treating the soil before sowing with solutions of sulphate of copper, sulphate of iron, and a dilute solution of sulphuric acid, but they turned out more injurious than useful. In Germany, the fungus causing this disease, is known by the expressive name of wheat-stem killer, and was determined there by Frank (13), in 1894.

Cordley (26), describes a disease occurring in Oregon, U.S.A., which has all the characteristics of this one, although only the fungus mycelium has been found.

Treatment Recommended.

To the farmer who sees his best wheat-crops going off in patches, and his yields considerably diminished by this disease, the main question at issue is, how to prevent it altogether, or at least to lessen the loss caused by it, and he invariably asks "Is there any cure or preventative for this disease?" As to cure, it is evident from the nature of the case, that it cannot be attempted. When the feeding roots of the plant have been attacked by the fungus, which works, so to speak, in the dark, the disease only becomes manifest through the sickly appearance of the plants, when the fungus has gained such a firm hold, that the plant soon droops and dies, then it is too late to intervene. But as regards prevention, there are various means whereby the fungus may either be destroyed, or starved, or circumvented, and these measures are based upon a knowledge of the nature of the enemy we have to fight and the tactics it adopts to secure its ends.

As we have seen, the fungus is in the soil, and not in the seed, and therefore in order to destroy it there, special measures may be recommended.

In France, various manures have been tried to check this fungus, and the best results were obtained from a dressing of Thomas phosphate. During this season, the disease occurred in well-manured paddocks, but there may be some ingredient more destructive than others, and various combinations will be experimented with.

The Agricultural Chemist, Dr. Howell, writing under date 23rd November, 1903, says:—"Two years ago when take-all and white-heads were rather bad in the North, I inspected several fields very closely, and found the trouble as bad in the unmanured as the manured plots. I saw no reason for believing that the Thomas phosphate then showed any preventive effect. However, I do not wish to throw any doubt upon the truth of the results of French investigations. These may possibly find confirmation in future experiments in Victoria. A very much smaller increased yield, however, produced by Thomas phosphate in the North than by superphosphate, is a point which will require consideration, whatever the effect may be in the direction referred to by you." The soil might also be treated with various solutions before sowing, to act as fungicides, but the application of sulphate of copper, sulphate of iron, and sulphuric acid, was not a success in France. However, Mr. Farrer, Wheat Experimentalist, speaks favourably of sulphate of iron, for he states in the Agricultural Gazette, of New South Wales, for 1900, at page 716, that he gave his land that had patches of take-all, a dressing of about 70 lbs. to the acre in the early spring, and since then, he has not been troubled with it. He considers, however, that 1 cwt. per acre would not be too much for a dressing.

Burning the stubble should also tend to check the fungus, and although collecting the stubble and burning it seemed to have no practical result in France, the farmers here are almost unanimous that if they get a good burn over the patches, take-all does not reappear

for some time. In any case, innumerable spores would be destroyed in this way, and the spread of the disease checked to some extent. With small patches it would be practicable to spread a heavy layer of straw or litter over them, and burn off, a practice more likely to be beneficial if the spots are first dug over or scarified, so as to loosen the soil and bring as much of the diseased remains of the old crop within the influence of the fire as possible.

The method of direct attack is however, not the only course open, for the fungus may be starved into submission instead. So far as is known with certainty at present, the *Ophiobolus* is only capable of attacking wheat in this country, though barley and one or two grasses may possibly serve as hosts for the parasite. It is, however, certain, that oats are exempt from this disease, and the experience of farmers bears this out, for although Dr. Cobb (11), speaks of take-all in oats, yet, on his own showing, quite a common and different fungus was present, not the wheat-stem-killer, and he significantly adds—"The soil where the plants were most unhealthy, seemed damp and cold and forbidding." Oats grow well on take-all patches, and after two or three crops, the fungus dies out, because it is deprived of its natural food, and wheat may be safely grown again. But it must be remembered that the minute reproductive bodies may survive for a long time in the soil, and the land may become reinfected by blown sand, &c., so that this method lessens the evil, but does not entirely remove it. And here it may be well to point out, that growing wheat after wheat on the same land is not only bad farming practice, but it is the surest means of perpetuating the fungus in the soil, as a fresh crop of the fungus is produced year after year. A rotation is wanted which will keep the land clear and in good heart, and at the same time be inimical to the fungus, for it has been said that in Europe, leguminous crops, such as peas, beans, clovers, &c., render the wheat-plant more suceptible to this disease, by favouring the growth of the fungus. Whether the same result would follow here remains to be determined, but the question is not of much importance as yet, because in most of our wheat districts these crops cannot be grown. It may also be possible to circumvent the fungus, by rendering the surroundings unfavourable to its developement, and working the soil so that it is hindered in its spread.

It is a general opinion among farmers, taking a number of average seasons into account, that crops on early fallowed land, with plenty of rain, escape the take-all, for this exposes the soil to the continued action of the sun, and the humid condition favours the germination of the spores, so that their death would probably soon ensue in the absence of suitable plants to live upon. On the other hand a late fallow, followed by a dry season, is regarded by many as worse than no fallow at all, since this would probably cause the spores to remain quiescent, and only to germinate about the same time as the wheat-plant. Dry-worked land is found to be very subject to it, for this simply encourages the spread of the spores, and allows the fine filaments of the fungus to grow freely and reach the roots of the wheat-

plant; whereas working the land only when wet prevents this. Rolling after sowing would also tend to consolidate those loose lands which are perhaps more subject than others to take-all, and feeding off the crop with sheep, where sufficient growth takes place, would produce a hardier and more resistant plant.

This suggests another method of dealing with the fungus. It has been found in other countries that some varieties are more susceptible to the disease than others, and farmers should be on the alert to select any that have this resisting power. Early varieties are said to be the most susceptible, probably because they are more certain of being infected by the germinating spores, and red wheats such as Chidham and Essex were found in France to be resistant. Here again, however, European experience is not likely to benefit us much, since red wheats are practically useless here, and late wheats of little value; but among our own Australian wheats we may find some more resistant than others.

Summary.

1. The diseases of wheat popularly known as take-all and white-heads or dead-heads, in Australia, are different stages of one and the same disease, and are caused by the fungus scientifically known as *Ophiobolus graminis*, Sacc.

2. The same disease occurs in Europe and elsewhere under various names—Straw Blight in Britain, Foot-rot or Black-leg in France, and in Germany the appropriate name of Wheat-stem-killer is applied to the fungus.

3. It has been known in South Australia as far back as 1852, and was firstly definitely determined as a cause of disease in France, in 1878, although its effects had been observed 25 or 30 years before that. In Britain it specially attracted scientific attention about 1884, and was then well-known to farmers, and particularly noted as injurious in Germany in 1894.

4. It exists in the soil, and attacks the roots of the wheat-plant, causing it to die either in its early stages (Take-all), or after producing its ears usually without the development of grain (White-heads).

5. In dry seasons and in certain periods of the year, only the vegetative portion of the fungus may be found, hence the long time the disease has been with us without a recognition of its true nature.

6. The fungus has also been found on species of *Agropyron* in Italy, but the native grass or grasses on which it harbours here are not yet known.

7. Of the various means tried to overcome or counteract it, the best results hitherto have been obtained in Europe, from the application of Thomas phosphate to the soil, and subsequent rolling; and in New South Wales, Mr. Farrer reports success with 70 lbs. sulphate of iron per acre, applied to the patches. In Victoria, however, Dr. Howell does not consider that Thomas phosphate produced any preventative effect.

8. The oat grows well in take-all patches, and is not attacked by the fungus, hence it is recommended for starving it out.

9. The earlier varieties of wheat are considered in Europe to be the worst affected, but none grown here can as yet be said to be resistant.

10. The kind of soil seems to exercise some influence upon it, for though the disease occurs on poor and rich land, yet crops on the looser friable soils generally suffer more or die at an earlier stage. Any measures which tend to improve the mechanical condition are beneficial, such as early fallow, working the land only when wet, feeding off with sheep if growth is strong, and rolling after sowing.

11. A proper rotation is strongly recommended, since the fungus may be starved out by depriving it for a time of its normal food, the wheat-plant.

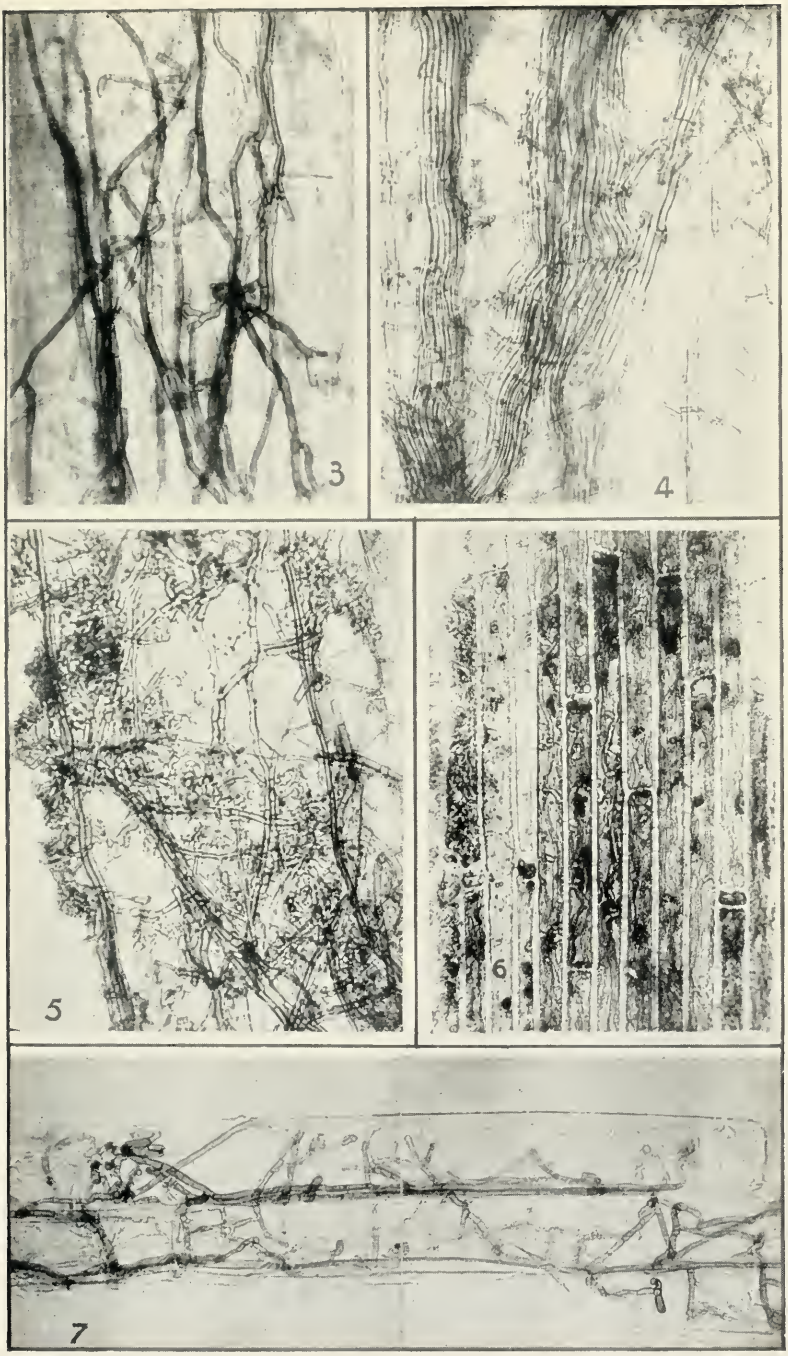
In conclusion I have to thank all those who kindly aided me in this investigation by means of information or specimens, and among them may be specially mentioned Messrs. Molineux and Summers of South Australia, and in Victoria, Messrs. Smith of Horsham, Peters of Goornong, Schlitz of Quambatook South, Adams of Laen, Towns of Nhill, Payne of Netherby, and Pescott, Orchard Inspector.

Explanation of Plates.

Ophiobolus graminis, Sacc.

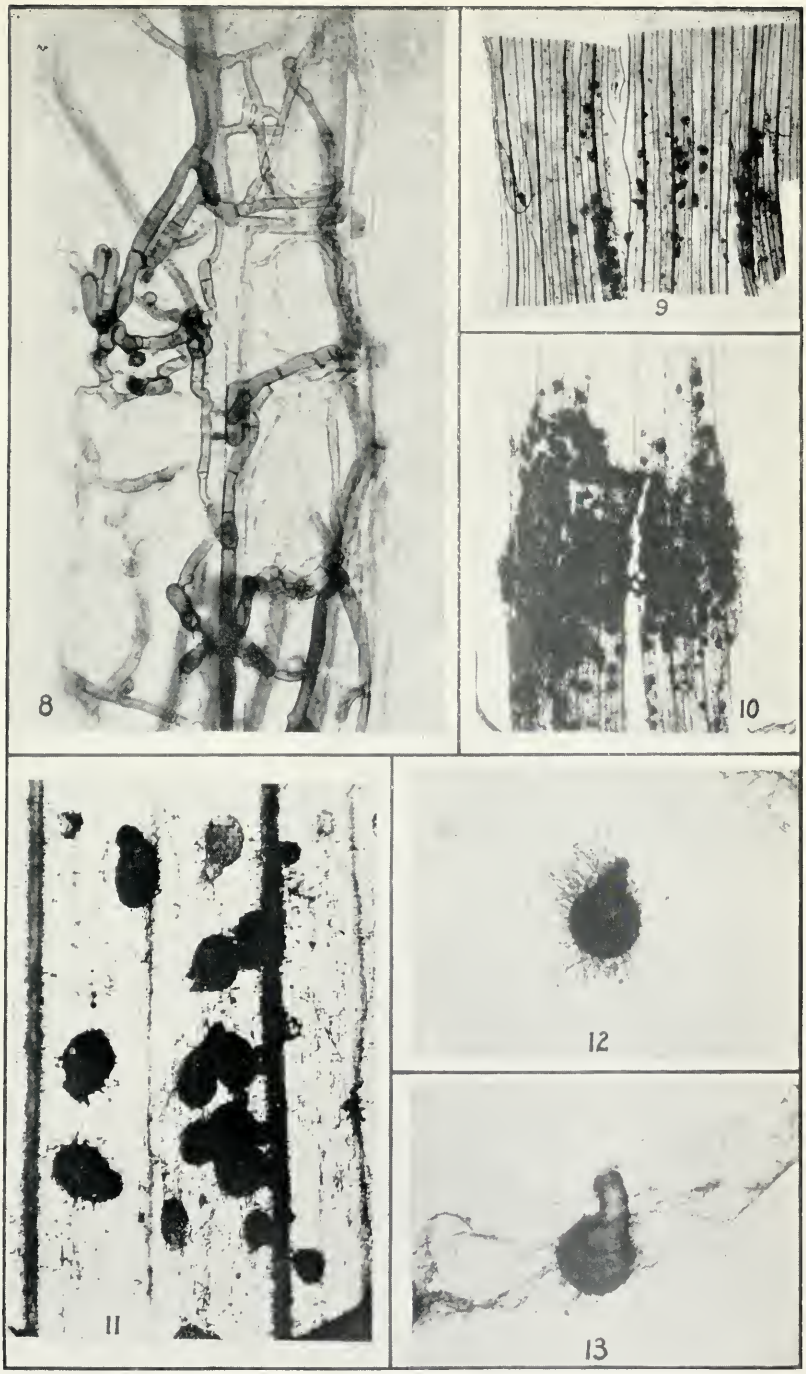
Fig.

1. Young wheat plant killed by the take-all fungus (nat. size).
2. Wheat plant killed by the take-all fungus just before the formation of the ear. The black dots near the base of the stem are the fruiting portions of the fungus, and the roots have broken off short when the plant was pulled (nat. size).
3. Mycelial filaments from inner surface of sheath of diseased plant ... ... × 200
4. Mycelial filaments joined to form broad bands, from inside of sheath ... ... × 200
5. Plate mycelium coating the stem (between innermost sheath and stem) ... ... × 200
6. Portion of stem of diseased plant, showing the dark mycelium within the cells ... ... × 200
7. Mycelial filaments from inside of sheath ... ... × 200
8. Part of Fig. 7 more highly magnified ... ... × 400
9. Portion of sheath of diseased plant showing as numerous black dots the fruiting portion or perithecia of the fungus ... ... × 3
10. Portion of sheath from a long dead plant showing the densely crowded perithecia of the fungus ... ... × 3



G. H. Robinson, Photo.

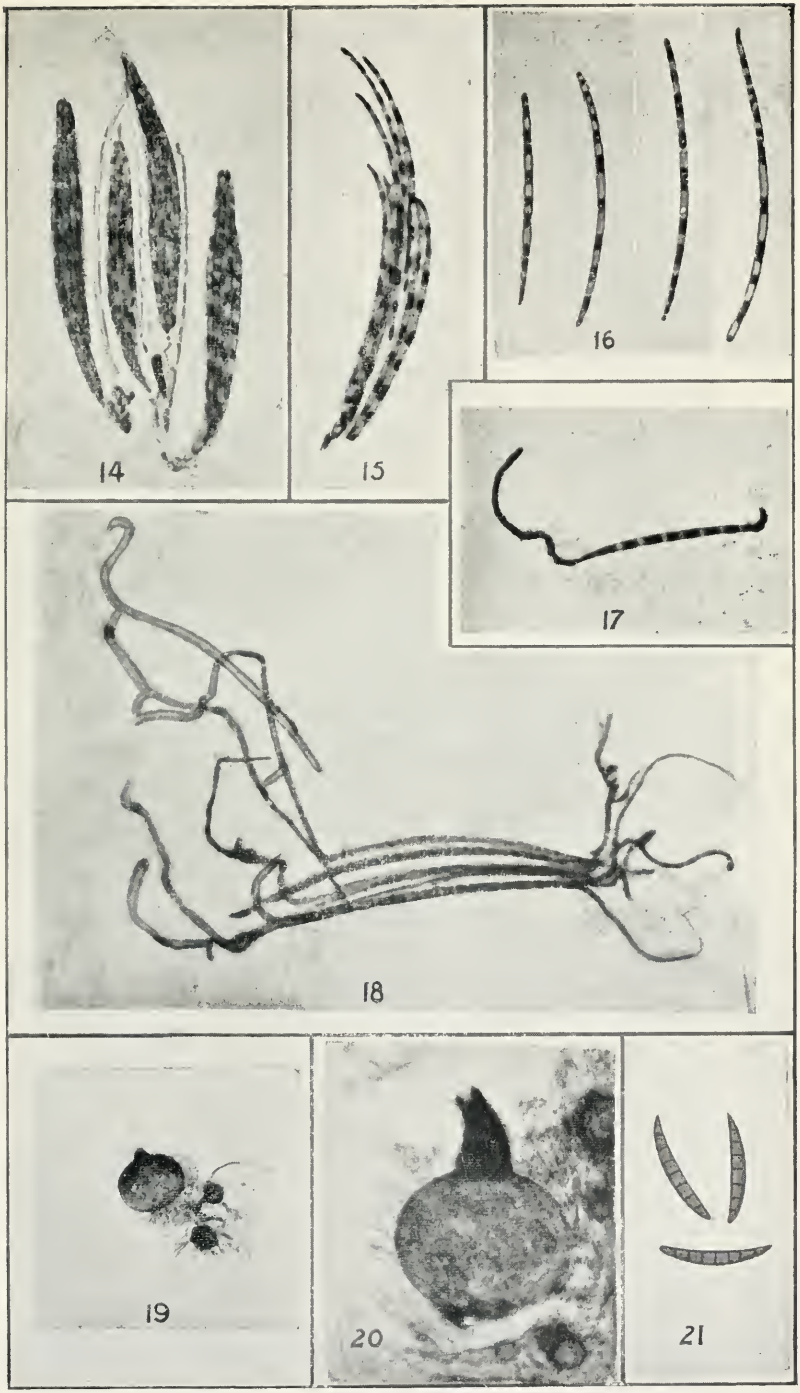
THE TAKE-ALL FUNGUS
(*Ophiobolus graminis, Sacc.*)



G. H. Robinson, Photo.

THE TAKE-ALL FUNGUS.

(*Ophiobolus graminis, Sacc.*)



G. H. Robinson, Photo.

THE TAKE-ALL FUNGUS.
(*Ophiobolus graminis, Sacc.*)

11. Portion of Fig. 9 more highly magnified ... ... ×15
12, 13. Perithecia taken from the sheath of take-all plants, and showing the hairy mycelium attached ... ×30
14. Four spore-sacs or asci containing spores, with filiform paraphyses between some (stained with carbol-fuchsin) ×400
15. Several spores not yet separated from each other (stained with carbol-fuchsin) ... ... ×400
16. Several spores of varying sizes (stained with carbol-fuchsin) ×400
17. Spore germinating after 48 hours in boiled tap water (stained with carbol-fuchsin) ... ... ×400
18. Bunch of spores germinating as before.

Hendersonia graminis n.sp.

19. Perithecium of the Hendersonia ... ... ×30
20. ,, ,, ... ×100
21. Spores of the Hendersonia ... ... ×400

NOTE.—All figures, except the last, original photographs and photo-micrographs by G. H. Robinson.

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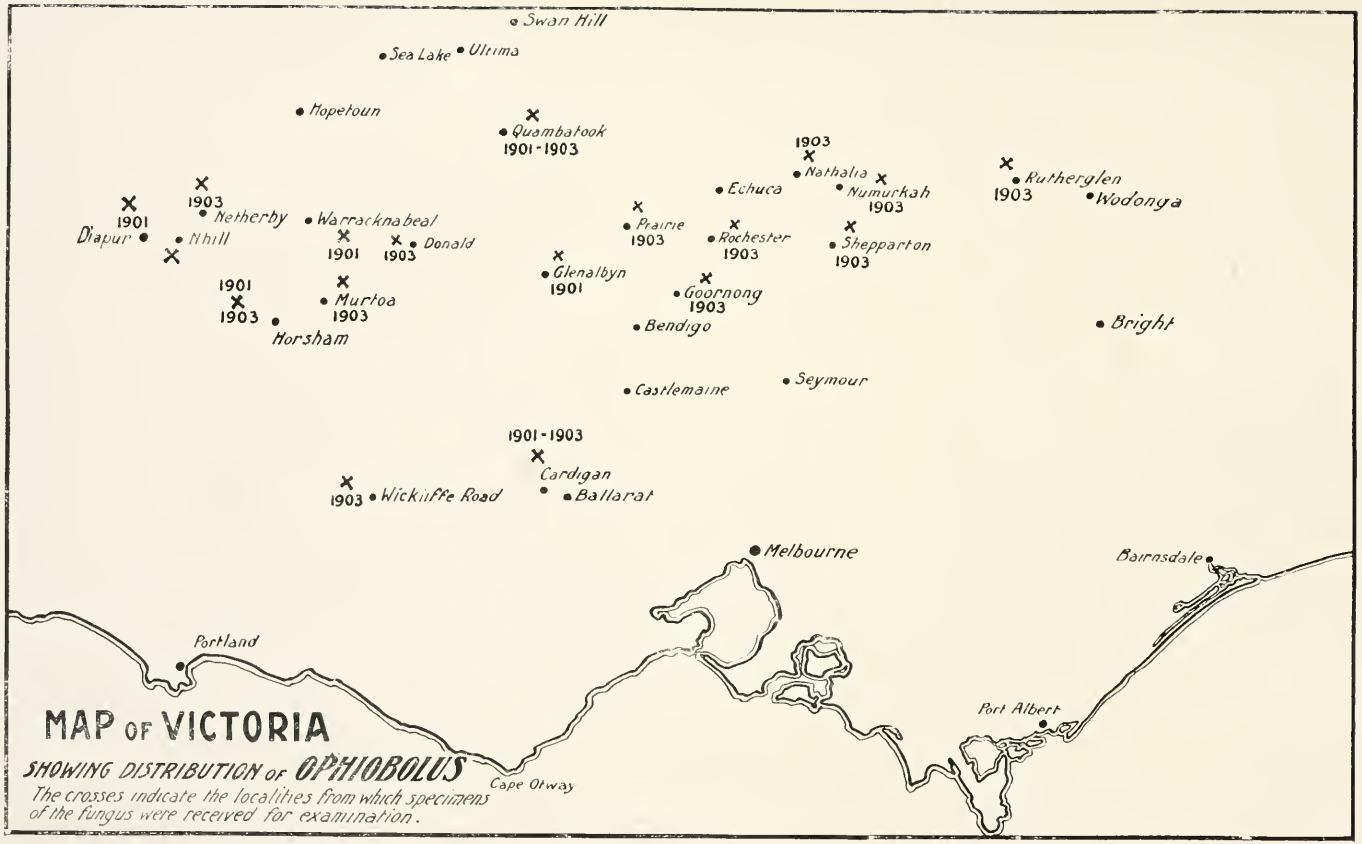

Swan Hill
Sea Lake
Ultima
Mopetoun
Quambatook
1901-1903
1903
Nathalia
Echuca
Numurkah
1903
Rutherglen
1903
Wodonga
1903
Netherby
Warracknabeal
1901
Diapur
Nhill
1901
1903
Donald
Prairie
1903
Rochester
1903
Shepparton
1903
Glenalbyn
1901
Goornong
1903
1901
1903
Murtoa
1903
Horsham
Bendigo
Bright
Castlemaine
Seymour
1901-1903
Cardigan
1903
Wickliffe Road
Ballarat
Melbourne
Bairnsdale
Portland
Port Albert
Cape Otway
MAP OF VICTORIA
SHOWING DISTRIBUTION OF OPHIOBOLUS
The crosses indicate the localities from which specimens of the fungus were received for examination.

BUSH FIRES AND STUBBLE BURNING.

By H. Pye.

In writing these few notes on bush fires and stubble burning, it is apparent that some matters of interest might be drawn attention to, which would have a practical bearing in regard to rural economy. Also it is likely that farmers, when they burn their stubbles, are not, as a rule, aware of the comparative losses and gains to the land, due to following this practice, which is every year becoming more general. The bush fires of Victoria, and of the other States of the Commonwealth, often cause great loss to farmers, both directly and indirectly. The direct losses are principally the burning of the pasture grasses, crops, fences, homes, and occasionally some of the stock. The indirect losses do not appear to the farmer of much consequence, yet on investigating them it will be apparent that they may be serious, as for instance, owing to the destruction of insectivorous birds.

The loss of forest seedlings, and many old forest giants in timber reserves, is often very great. These reserves are rapidly diminishing, and even the firewood supplies of large cities are every year being obtained from more distant parts. In order to safeguard the interests of farmers and graziers, laws have been passed in order to check the frequency of bush fires; but in spite of this, they are more general than they should be. The supreme indifference of some persons to fires is very exasperating to those who know what direful results may follow when they occur, hence smoking should strongly be discountenanced, and even made a misdemeanour, if it take place anywhere where there is a possibility of a spark falling on the grass. Perhaps if graziers and farmers whose properties lie in the route of swagmen were to make suitable provision, and encourage the swagmen and others to boil their billies in places prepared for such purposes, there might be some hope of fewer fires. The use of wax matches should also be discouraged, as there is no doubt that they are the cause of more fires than is generally thought.

Doubtless there is no economical method of clearing timbered country that is far from a large city, except by burning. It is a pity that such is the case, but it is inevitable. In countries where the trees shed their leaves every year, the land receives much organic matter; and this, together with the earth, forms a rich layer of soil that will grow almost any farm crop. Old grass, too, supplies organic matter to the soil, and renders it more absorbent for moisture, whilst it also induces a better retention of it. The presence of this organic matter prepares the soil for the increase of bacterial life so necessary for inducing fertility in soils; thus grass fires, especially, are not only the cause of much direct loss to the stockowners, but the burnt grass represents a loss of much organic matter that has taken a considerable time to be extracted from the air and soil. The mineral matter alone

is left, whilst the remainder passes away in a gaseous form, with the exception of a little charcoal that may not be completely burnt away. The fire, if a severe one, destroys a good deal of beneficial bacterial life, and frequently there is none too much of this in the greater number of our soils, hence one cause, and a prominent one, for infertility. Certainly it may become rather mystifying, knowing this, to determine what should be done when there is a large area of coarse grass on a grazing run. As a rule it is found more economical to burn it off, and look to the young sweet growth as a recompense. If the latter be cut early enough it would likely make a second class ensilage, but this presupposes that the land is sufficiently clear for the carrying out of the work, and that labour is available. It would be advisable to endeavour, as soon as possible, to replace the coarse grasses by the finer kinds, and so reduce the necessity for burning off. In the northern parts of the State there is rarely much of this grass, as these heavily stocked areas are so well grazed by sheep that the old grass is useful for a time in protecting the young shoots coming through it. In some parts the grass and scrub are burnt in order to destroy ticks and other parasites. How far this is successful is a moot point; theoretically, however, the loss of organic matter is an important factor; but left to natural conditions the decay of the vegetable matter is so slow that it is necessary in some instances to burn off the coarse herbage at regular intervals, unless paper mills were close at hand, when it would pay to cut the grass. Frequently it is the burning off of these areas that starts many severe bush fires, since insufficient precautions are taken to keep the fires well under control. In regard to the finer class of grasses, the old growth is the natural protection of the young growth from frost, and when it decays each year, acts as a natural mulch and seed bed. The better the pasture grasses the more reason that, even when dry, they should be preserved from fires, irrespective of their usefulness for stock during the summer and autumn.

The burning of the stubble after stripping is certainly a retrogade movement on farms, as it is so much energy misdirected or lost to the farm, only mineral matter is left, which primarily has been obtained from the soil, and is simply returned to it as a light top dressing. All the organic matter so needful to our soils, and whose absence is, without doubt, one of the chief causes of infertility in many instances, passes into the air from which it came. This act of burning, practically speaking, means that the plants, after their season's work, leave only a few ashes drawn from the soil, also the roots, to show for it. The stored-up energy has been dissipated, and has passed to other channels, but the soil gains little in comparison to what it should. There is no doubt but that our wheat areas are rapidly losing their fertility from the absence in the soil of this organic matter. It is interesting to unravel the skein of mystery that we see before us every day in our crops, and to ask seriously, is it right that we should burn our stubbles? Do we really cheapen the cost of farming, or is it an ephemeral practice that will leave us sadly disappointed in the end? There is no doubt but that stripping is a

wasteful method when carried out systematically, and can only be excused when lack of capital forces a man to choose this method of harvesting. A farmer who keeps stock should not, if possible, resort to it as a general practice; the unreliability of the labour market, and the absolute necessity for reducing current expenses forces the farmer to do many things that he would not attempt otherwise, and one of these is stripping. Nevertheless the practice is not a good one, and this has been exemplified during the drought this year, since straw is so scarce over the northern parts of Victoria. Great as the loss of straw is felt for stock, a still greater loss is that felt by the land of organic matter, and whether this is supplied by green manuring, stable manure, or from straw rotted in the piggeries, byres, or small yards, or by the cattle eating it from the stacks in the outfield, the same general results are derived. There is one thing certain, our wheat-growing area is less able to retain and absorb moisture, is drier in dry weather, more sloppy in wet weather, and colder during the winter and spring than it would be if sufficient organic matter were present. We find that light dressings of fertilizers give the more economical returns, firstly because of the light rainfall, and partly because the amount of humus present in the soil is, as a rule, too small. Also thorough cultivation is not general, thus the texture of the soil is not conducive to the retaining of moisture, and the application of heavier dressings of fertilizers. At present there is no need to expand on this matter, but it is necessary to show that the straw burnt is a real loss to the farmer.

The chief advantages gained by burning the stubbles are:—

1. Cheapness and rapidity of harvesting.
2. Reducing the amount of humus in soils already too rich in it.
3. Destroying fungus and insect pests.

The following are some of the disadvantages:—

1. Loss of humus or organic matter, which applies to most soils.
2. Loss of nitrogen.
3. Loss of beneficial bacterial life.
4. Absence of straw during winter and droughty seasons.

In order to check bush fires from carrying all before them, if some headlands be cultivated and kept free from weeds, and then about October were sown down with broom corn or sorghum, a good fire-break would be at hand, whilst after harvesting the crop, the stock put on the stubbles would have a good bite of green feed, or the broom corn could be marketed if the fibre were a good sample.

Every farmer who has valuable stacks of hay or wheat is careful to have a fire-break around them, as well as around his homestead and buildings. Such simple precautions are often the means of saving much valuable property from destruction, especially if a few beating appliances are kept handy.

There are a number of preparations for rendering canvas and sacking more or less fire-proof, one being :—Boracic acid, 3 lbs.; salammoniac, 7½ lbs.; borax, 1½ lbs.; water, 5 gallons.

For wearing apparel or bedding, an ounce of alum, borax, or salammoniac, dissolved in the last water in which the fabrics are rinsed, renders them less likely to catch fire, whilst the ordinary water glass used by the farmers for preserving eggs, if painted over boards renders them to some extent fireproof, so also does a mixture of sulphate of ammonia and sulphate of lime.

Most farmers have had experience of bush fires, and it will be generally admitted, that during those times the sterling neighbourly worth of every individual farmer is very pronounced. It is astonishing the long distances that recruits to the band of firefighters come, and they work hard and long, yet how much better would their assistance be if better organisation, and better methods of fighting the fire were known.

CHEESE MATURING AT LOW TEMPERATURES.

By R. Crowe.

According to reports of experiments conducted in the United States and Canada up to last year, the results of maturing cheese at low temperatures were so promising as to warrant trials on a large scale being undertaken. Under the old system a considerable loss occurred through evaporation of moisture from cheese while ripening and leakage of butter fat, especially in the summer time. The overheating and drying, whilst facilitating early curing rendered the cheese less mellow in flavour, and gave waste in the shape of a thick rind. It was at once recognised that if beneficial results were secured in Canada where the climate is colder, and the air more humid than ours, no time should be lost in testing the method locally. Generally speaking, the greatest fault noticeable in Victorian cheese is its dryness; it is mealy in texture, and does not break down on the palate as good cheese should. This is not to be wondered at when it is remembered that few of the farms where cheese is made have suitably insulated maturing rooms. On hot days, the temperature gets up to 80, 90, and even 100 degrees F. sometimes, and on such occasions the shelves and floor are flooded with butter fat, that has run from the cheese, rendering it poorer, drier, and less palatable. Even the factories suffer in this direction in the height of summer; therefore, it was concluded, even before a start was made, that in the new system there was promise of great things for the Victorian cheesmaker.

This time last year arrangements were made for a few cheeses to be placed in cool store, instructions were given to those makers who kindly consented to assist, asking them to forward half of the make from one vat of milk and keep the remainder to be treated in the usual manner, and weigh regularly at monthly intervals.

Lot No. 1.—The first lot of two cheeses came from a farm on December 10th, 1902, being taken out of press the day before, and weighed 76¼ lbs., was placed in a temperature of 32 degrees F. and 75 per cent. humidity. On July 9th, seven months afterwards, the weight was 70 lbs., showing a shrinkage of 8·15 per cent. The second set from the same maker arrived on 17th December, 1902, weighing 69¼ lbs., and on 9th July weighed 63 lbs., making a shrinkage of 8·6 per cent. The third set reached us on 23rd December, weighing 75¼ lbs., and on 9th July weighed 70 lbs., showing a reduction of 6·95 per cent. Nearly one-half of the total shrinkage occurred in transit and during the first month of storage.

The weight of the duplicates on the farm totalled 219 lbs. when made, and on the 9th of July weighed 193½ lbs., indicating a reduction of 25¾ lbs., or 11·7 per cent. The average shrinkage in the cold-stored cheese was 8 per cent., so a saving in weight is shown of 3·7 per cent. in favour of the system.

On making a comparison of quality at the end of the test, there was a difference of opinion, the general conclusion, however, was that for current local consumption, the cheese matured at the factory was the better lot, whilst for shipping, that kept in cool store was preferred, as it was less ripe and cleaner in flavour.

Lot No. 2.—The second lot for which incomplete data were kept by the maker, arrived on the 20th January, 1903, weighing 120½ lbs. It was placed in a chamber at 40 degrees F., with 60 per cent. humidity. On 20th February, the weight had decreased to 119 lbs.; on 20th March to 117½; and on the 20th April to 116, making a total shrinkage of 3·7 per cent. The weight of the duplicates kept at the factory were not recorded as arranged. As regards quality, the agents reported that that kept in cool store was worth from ½d. to 1d. more per lb. than that ripened at the factory.

Lot No. 3.—The third lot was put into the chamber and kept at 40 degrees F. and 60 per cent. humidity. Two large cheeses arrived on the 15th January, 1903, weighing 82½ lbs. On the 29th June, five and a half months afterwards the weight was 78 lbs., indicating a shrinkage of 5·4 per cent. The duplicates matured at the factory weighed 84¼ lbs. when made, and on 29th June 76½ lbs., showing a reduction in weight of 9·1 per cent. From the same factory two small cheeses weighing a total of 25 lbs. were received on 23rd January, and on 29th June, five months and one week later, the weight was 22½ lbs., which was equal to a shrinkage of 10 per cent. The duplicates at the factory weighed 25¼ lbs. after taking from press, and on 29th June 21½ lbs., showing a shrinkage of 14·8 per cent. The difference in favour of the cheese ripened at the low temperature amounted to a saving in weight of 3·7 per cent. in the case of the large cheeses, and of 4·8 per cent. with the smaller ones. The general opinion as regards quality was in favour of the cheese ripened at the cool stores, as it was cleaner in flavour and suitable for a wider range of customers than the duplicates matured at the factory.

Lot No. 4.—The fourth experiment was also with factory-made cheese, which reached us on 20th January, 1903; it consisted of four large and four small cheeses. The weight of the large was 161 lbs. on arrival, and on 30th June, five months and one week later, the weight was 152 lbs., showing a shrinkage of 5·5 per cent. After it was received it was stored at a temperature of 40 degrees F., with 60 per cent. humidity. The duplicates matured at the factory at from 60 to 62 degrees F., weighed 166½ lbs. when made, and on 30th June the weight was reduced to 151 lbs., indicating a shrinkage of 9·3 per cent., or a saving of 3·8 per cent. in favour of cold storage.

The four small cheeses on arrival weighed 44 lbs., and on 30th June, five months and a week later, weighed 40¼ lbs., showing a loss of 8·5 per cent. The four duplicates at the factory weighed 44 lbs., and finally weighed 39 lbs., showing a reduction in weight of 11·1 per cent., or a saving of 2·6 per cent. in favour of low temperature ripening.

The quality in this case, as with lot 3, was in favour of cheese ripened in cool store.

Lot No. 5.—The most comprehensive of the series of experiments was commenced with cheese made at the factory on 26th February, 1903. It was taken out of press on 27th, and nine large cheeses were received on 5th March, just one week after date of making. Three of the cheeses were coated with paraffin wax, three were wrapped in parchment paper, and the remaining three left in the ordinary way. Those were divided into three sets of three, each composed of one coated with wax, one covered with parchment, and one left plain; one set was placed at a temperature of 32 degrees F. with 45 per cent. humidity, one set was kept at a temperature of 40 degrees with 60 per cent. humidity, and the third set at 50 degrees F. with 95 per cent. humidity. The six duplicates were treated in the factory in the ordinary way, and the maturing room kept at a temperature of from 60 to 62 degrees F.

The following tables give details of weights, etc.

Lot 5a.

CHEESE MATURED AT GOVERNMENT COOL STORES.

Weight on arrival .. .. .. 129 lbs. 9 ozs.
Weight 25 weeks after .. .. 125 lbs. 8 ozs.
Loss per cent., 3·1.

	No. of Cheese.	Temperature Stored at.	Humidity.	Weight in Lbs. March 5th.	April 20th.	May 13th.	July 9th.	August 5th.	Loss % after 22 weeks in cool store.	Weight in Lbs. August 26th.	Loss % after 3 weeks out of cool store.
		deg.	%	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.		lbs. oz.	
Coated with Paraffin wax..	1	32	75	43 10	43 8	43 8	43 4	43 0	1·4	43 0	—
Wrapped in Parchment ..	2	32	75	43 10	43 0	43 0	43 0	42 0	3·7	42 0	—
Plain	3	32	75	42 5	41 8	41 8	41 0	40 8	4·2	40 8	—
Total Weights		..	..	129 9	128 0	128 0	127 4	125 8	3·1	125 8	—

Lot 5b.

CHEESE MATURED AT GOVERNMENT COOL STORES.

Weight on arrival 5th March .. 135 lbs. 13 ozs.
Weight 25 weeks after .. .. 131 lbs. 0 oz.
Loss per cent., 3·5.

	No of Cheese.	Temperature Stored at.	Humidity.	Weight in Lbs. March 5th.	April 20th.	May 13th.	July 9th.	August 5th.	Loss % after 22 weeks out of cool store.	Weight in Lbs. August 26th.	Loss % after 3 weeks out of cool store
		deg.	%	lbs. oz,	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.		lbs. oz.	
Plain	4	40	60	45 6	44 8	44 0	43 8	43 8	4·1	43 8	—
Wrapped in Parchment ..	5	40	60	45 6	44 8	44 8	44 0	43 8	4·1	43 8	—
Coated with Paraffin wax..	6	40	60	45 1	44 8	44 8	44 0	44 0	2·3	44 0	—
Total Weights		..	..	135 13	133 8	133 0	131 8	131 0	3 5	131 0	3·5

LOT 5C.

CHEESE MATURED AT GOVERNMENT COOL STORES.

Weight on arrival 5th March .. 129 lbs. 3 ozs.
Weight 25 weeks after .. .. 128 lbs. 8 ozs.
Loss per cent., 0·53.

	No. of Cheese.	Temperature Stored at.	Humidity.	Weight in Lbs.					Loss % after 22 weeks in cool store.	Weight in Lbs.	Loss % after 3 weeks out of cool store.
				March 5th.	April 20th	May 13th.	July 9th.	August 5th.		August 26th.	
		deg.	%	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.		lbs. oz.	
Wrapped in Parchment ..	7	50	95	44 0	44 0	44 0	44 0	44 0	—	43 8	1·0
Plain	8	50	95	42 0	41 8	41 8	42 0	42 0	—	41 8	1·0
Coated with Paraffin wax..	9	50	95	43 3	43 3	43 0	43 8	43 8	—	43 8	—
Total Weights				129 3	128 8	128 8	129 8	129 8	—	128 8	·77

CHEESE KEPT AT A TEMPERATURE OF 60 TO 62 DEGREES IN THE COBRICO CHEDDAR CO'S. MATURING ROOM.

Total weight when taken from press, 27th February, 1903 .. 264 lbs.
Weight 24 weeks after .. .. 243 lbs.
Loss per cent., 7·95.

	Weight in Lbs.						Loss per cent.
	February 27th.	March 12th.	April 4th.	May 18th.	June 15th.	August 15th.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
TOTAL WEIGHT ..	264	260	255½	252½	248	243	7·95

LOT 5E.

SUMMARY OF CHEESE MATURED AT GOVERNMENT COOL STORES.

Weight on arrival 5th March .. 394 lbs. 9 ozs.
Weight 25 weeks after .. .. 385 lbs. 0 oz.
Total loss per cent., 2 4.

No. of Cheese.	Temperature Stored at.	Humidity.	Weight in Lbs.					Loss % in 22 weeks in cool store.	Weight in Lbs.	Loss % after 3 weeks out of cool store.
			March 5th.	April 20th.	May 13th.	July 9th.	August 8th.		August 26th.	
	deg.	%	lbs oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.		lbs. oz.	
1, 2, and 3 ..	32	75	129 9	128 0	128 0	126 4	125 8	3·1	125 8	—
4, 5, and 6 ..	40	60	135 13	133 8	133 0	131 8	131 0	3·5	131 0	—
7, 8, and 9 ..	50	95	129 3	128 8	128 8	129 8	129 8	—	128 8	·77
Total Weights			394 9	390 0	389 8	388 4	386 0	2·1	385 0	2·4

CHEESE MATURED AT COBRICO CHEDDAR CO'S. FACTORY.

Weight when taken from press .. .. 264 lbs.
Weight 24 weeks after .. .. .. 243 lbs.
Loss per cent., 7·95.

With lot 5 A a loss of 3·1 per cent. occurred in 25 weeks; with lot 5 B a loss of 3·5 per cent.; and with lot 5 C nothing, whilst the cheese was in cold store, but during three weeks afterwards, the loss totalled 0·77 per cent. The total average shrinkage equalled 2·4 per cent., whilst the reduction in those kept and matured at the factory equalled 7·95 per cent., showing a saving in favour of the average cold storage conditions of 5·55 per cent.

As regards quality, the cheese matured in the factory was more valuable for current local consumption, as it was more ripe and fuller in flavour. The cheese kept in the cool store was milder in flavour and newer, and would therefore keep longer and develop into a cheese of very fine flavour.

The Influence of Humidity in Ripening.

It will be noticed that the average shrinkage in the case of the cheese stored at 32 degrees, was 3·1 per cent.; that stored at 40 degrees, 3·5 per cent.; whilst that at 50 degrees, showed no loss while in cool store, therefore, it would appear, that some factor other than temperature influenced the reduction in weight. The humidity of the atmosphere in the chamber at the lowest temperature as indicated by the relative temperature shown by the dry and wet bulb thermometers was fairly constant at 75 per cent. The air was considerably drier in the lock where the cheese was kept at 40 degrees F., showing 60 per cent.; whilst in the lock kept at 50 degrees, the atmosphere was almost fully saturated. It will be seen, therefore, that the drier the air the greater the loss through evaporation, lower temperatures notwithstanding.

Treatment with Paraffin Wax.

One of the third lot of two large cheeses, before referred to, was on arrival coated with paraffin wax, and the other left plain. They were both kept side by side in a temperature of 40 degrees with 60 per cent. humidity. The waxed cheese weighed 41½ lbs., and at the end of five and a-half months scaled 39½ lbs., showing a loss of 4·8 per cent. The one left plain, weighed 41 lbs., and at the end of the period mentioned, weighed 38½ lbs., incurring a loss of 6 per cent. An advantage is shown in favour of the use of paraffin wax in the shape of a gain of 1·2 per cent. In the case of lot 5 A, a saving in favour of paraffin wax is shown of 2·55 per cent.; in the case of lot 5 B 1·8 per cent., and with lot 5 C over 1 per cent. A peculiar result is shown in this table in the shape of a slight increase in weight instead of a reduction.

On October 8th, four cheeses were waxed, and weighed 33 lbs., and the duplicates left unwaxed, weighed 32½ lbs. The cheeses were kept at various temperatures, ranging up to 85 degrees occasionally, in a warehouse, in Melbourne, and at the end of five weeks, that coated with wax, showed no reduction in weight, whilst that left plain, had reduced by 1¼ lbs., or a reduction in weight of 3¾ per cent. Another lot of four was waxed, which weighed 46¼ lbs., and stored

with duplicates weighing 46¼ lbs. also, in another warehouse in the city. The loss in this case amounted to ½ lb. in five weeks against 1¾ lbs. in the case of the plain duplicates, showing a difference in favour of the use of the wax of 2⅕ per cent.

Conclusions.

The average shrinkage of all the cheese ripened at low temperatures under varying conditions, excluding that coated with paraffin wax, was 5·83 per cent.

The average reduction in weight of duplicates matured under ordinary conditions at the factories and farms, was 9·77 per cent. *The average saving in weight by keeping in cold storage was 3·94 per cent.*

The average shrinkage of cheese coated with paraffin wax, and kept under different conditions in cold store, was 2·02 per cent. The average reduction of plain duplicates kept in cold store under similar conditions to the waxed cheese, was 3·62 per cent. *The saving credited to the use of wax coating was 1·6 per cent.*

The average shrinkage in five weeks of cheese coated with paraffin wax and stored under ordinary conditions in warehouses was 0·63 per cent. The average reduction of duplicates was 3·81 per cent. *The saving on account of the use of wax was 3·18 per cent.*

Those results, it will be observed, have been secured under impromptu conditions, as no chamber was specially prepared or fitted for this class of work, and no expense incurred.

The experience leads to the conclusion that in a cool chamber suitably arranged and managed, the shrinkage could easily be limited to less than 3 per cent., and a saving effected as compared with even the most up to date curing rooms in the country at present of not less than 5 per cent. with the late spring and summer make of cheese. Already this season (30/11/03) the Department has received for maturing in cool store over 30 tons of cheese, for which a charge of 3d. per 100 lbs. is made for the first week, and 1½d. per week following. This is equal to about 5 months free storage, as the value of the cheese saved will be sufficient to cover charges for that time, and in addition, the cheesemaker is relieved of anxiety, labour, and expense in turning and attention during that period. More or less damage to quality is always incurred in connection with summer-made cheese.

The improvement in quality by cold storage will bring about an increased local consumption, and enable our cheese to secure more favour for export.

Paraffin coating gives a shiny appearance, which will likely meet with some prejudice at first, but its early and general use is certain, both in the case of cheese treated at the place of manufacture, and in cool store. The cost of material and application is small, amounting to but a fraction of the benefit effected.

Latest American Experience.

Since compiling the above data, reports have been received from Canada and the United States, further confirming the advantages of maturing cheese at low temperatures, and coating with paraffin wax.

Mr. J. A. Ruddick, Chief of Dairy Division, Ottawa (late Dairy Commissioner of New Zealand), states that the cool-curing of cheese is simply an attempt to create conditions, at all seasons, similar to those existing naturally when the very best results are obtained. On several occasions samples of cheese from the same batches, but cured at different temperatures, have been submitted to the Montreal buyers and other experts, and in every case they have pronounced the cool-cured cheeses to be superior in quality to the ones cured at ordinary temperatures. The difference in value has been placed as high as 1 cent. a lb.

Mr. R. M. Ballantyne, Montreal, in an address on Cool Curing of Cheese, at the Convention of the Dairymen's Association of Western Ontario, held this year, states that the introduction of cool curing is the greatest advance in the science of cheesemaking that has occurred within the past 20 years.

Professor Robertson, Commissioner of Agriculture, Ottawa, in commenting on Mr. Ballantyne's address, said that he quite agreed that the cool curing of cheese was one of the greatest advances made in the business during the last 20 years. He added:—"We had no less than 480 pairs of cheeses taken out of the same vats, 480 of them cured in a cool room, and 480 cured in the ordinary way, and never in one case were those cured in the ordinary way as good as those cured in the cool room. They were made in 37 different factories. There was not a single case where the cheese cured in the ordinary way was as good as that cured in the cool rooms, and there was less shrinkage in weight, and better texture, and better flavour."

A bulletin was issued in July last by the New York Agricultural Experiment Station, in which particulars of experiments by F. H. Hall, L. L. Van Slyke, G. A. Smith, and E. B. Hart, members of the staff are given. In the Popular Edition the following appears:—"The results of this experiment were so convincing that there has been no hesitation since in recommending to New York state cheesemakers and cheesehandlers the use of some form of cold storage for ripening cheese. The cheeses in these tests, which were cured at 50 degs. F. and lower temperatures, were markedly superior in quality to those cured in warmer rooms."

These tests and others elsewhere made, were so striking that Major H. E. Alvord, Chief of the Dairy Division, Bureau of Animal Industry, U.S. Department of Agriculture, determined to repeat them, in part, on a commercial scale, so that the benefits of cold curing might be shown to makers throughout the whole United States.

The cheese stored at 40 degrees F., had an increased market value of more than 1 cent. a pound over that stored at 60 degrees F.

By paraffining the cheeses, much of the loss in weight was prevented, especially at high temperatures, and the quality was improved in some instances; never lowered.

Briefly summarised, the advantages of curing cheese at low temperatures are the following :—

(1.) The loss of moisture is less at low temperatures, and therefore there is more cheese to sell.

(2.) The commercial quality of cheese cured at low temperatures is better, and this results in giving the cheese a higher market value.

(3.) Cheese can be held a long time at low temperatures without impairment of quality.

(4.) By utilizing the combination of paraffining cheese, and curing it at low temperatures, the greatest economy can be effected.

PASTEURIZATION.

By Jno. G. McMillan, N.D.D.
(Instructor in Cheese Making.)

Pasteurization is a subject that requires more serious consideration, by those connected with the Australian dairying industry, than has been given to it in the past.

Time was when milk was above suspicion, but by the rapid progress of bacterial science within the last 30 or 40 years, it has been shewn beyond the shadow of a doubt, that the erstwhile harmless fluid is an ideal breeding ground for germs of every kind, and the most sensitive of all mediums for the transmission of infectious diseases. It is now recognized that the dairying industry is fraught with very great responsibilities, calling for much anxious thought in the conduct of the trade, and making one and all engaged in the production and distribution of the milk supply important factors in the well-being of the community. While the social reformer may strive in vain to make our lives purer and better, it is within the power of the dairyman to make us live healthier lives.

We are indebted to science for having revealed to us the dangers of germ life, and putting within our reach the means whereby such danger may be minimised, if not altogether overthrown. The milk, when it comes from the cow, except the first few drops, and provided the cow's udder is sound, is absolutely sterile. But we have the difficulties to face, however, of the milk being exposed and handled in a germ-laden atmosphere, and an outbreak of disease amongst our herds.

To overcome these two sources of contamination, and restore the milk as nearly as possible to the immunity of bacterial life intended by nature, is the duty of every dairyman, and one which he now most effectually performs, if after taking every precaution to ensure his supply coming from healthy cows, and being handled with the most scrupulous cleanliness, he calls to his aid a careful system of pasteurization, which consists in heating milk to about 160° Fahr., and cooling it rapidly to a temperature of about 50°. It is, however, not necessary for me in this article to give details of the process of pasteurizing, as every dairyman ought to know about it by this.

The systematic application of pasteurization to the produce of the dairy is due to the pioneers of scientific dairying in Denmark, who, perplexed with bad flavours at times in their butter, determined to know the cause, and with the help of experts, found that it was due to the presence not only of bad bacteria, but also partly to weeds in the pastures, &c. They adopted pasteurization and pure cultures, the good result of which has been well demonstrated. Not only should this method be applied to butter factories, but it would be also a

great benefit to the general community if all the milk in our large Australian towns underwent the same process. The liability to contracting disease would be minimised, and the keeping quality of the milk increased. This system has been adopted by many leading dairy firms in Great Britain, and its virtues have been confirmed by bacteriological investigations. In Adelaide there is also a firm which has adopted the system with marked success; this, however, is a mere bagatelle to what is really required. What we want in our large towns are central depots, either municipal, co-operative or proprietary, where all milk could be pasteurized and cooled before being handed to the consumer. The system should be adopted not as an easy way out of the dairyman's responsibilities, but as a safeguard, which any practical man must feel it necessary to make, even after everything possible has been done to ensure cleanliness and freedom from contagion.

There are those, however, who fear that its adoption will encourage carelessness at the source of supply, and are evidently prepared to let our citizens run the risk of an occasional epidemic by their choice of a probable for an absolute guarantee. It would be grand to look forward to the day when all who attend to the milk supply, would exercise the care of a surgeon in an operating theatre, but I am afraid we will never attain this most desirable end. Our municipal and sanitary inspectors may see that the water supply of the dairy is free from contamination, and that the arrangements are everything that is required. The farmer may be compelled to see that the udders of the cows are healthy and clean, that the milkers' hands are washed previous to milking, and that he shall give immediate intimation of the appearance of any disease in his household or amongst his cattle, but however anxious we may be to have these conditions carried out, a visit to a farm on a wet, wintry morning will modify the hopes of the most sanguine.

Too often the cows are driven in from the paddocks into the yards, where there is no cover for them to dry, they are bailed up, the udder is covered with mud and dung, and is never washed, it being too dark to see, the milker begins operations at once, the rain-water comes trickling off the cow's back into the bucket, gathering in its course goodness knows what, and besides the water there is a large amount of dirt falling from the udder.

The milkers may wash their hands, but almost invariably it is done in the same bucket of water, unless there is a tap, and their hands dried with a piece of old bag, whose chief merit is that of not showing when it is dirty. However, there are to be found in Victoria some of the best dairymen it is possible to meet, who attend to every particular detail, but these I am afraid are greatly in the minority.

The tuberculin test may be applied to the herds, but it is found that in carrying out this test, there are always a few in every herd that re-act in a manner which raises doubt as to their being free from the disease, and often these animals are given the benefit

of the doubt, and are retained, and there is still the possibility of milk from that herd containing tubercle germs. Dr. Koch tells us that bovine tuberculosis is not transmittable to man, but his theory has been disputed by many investigators. By proper pasteurizing of milk, the immunity desired is sure and certain, and the sooner it is adopted the better will it be for the general health of the community.

Pasteurizing at the Butter Factory.

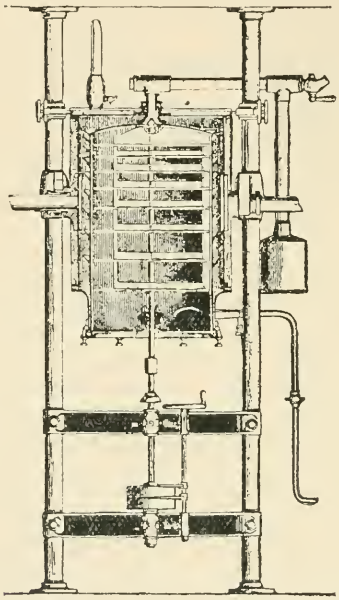
As regards the benefits of pasteurization from the butter factory's standpoint, there is much to recommend it. Pasteurizing may be likened to a farmer tilling his ground well; he tries to kill the weeds, but there are still the seeds left. However, if the soil is well prepared, the pure selected wheat, when sown, if the conditions are favourable for the growth of this crop, will very soon grow up and choke the weeds, and prevent them from developing. As it is in the wheat paddock, so it is in the cream vat. By pasteurizing we clean the cream of undesirable bacteria or weeds that are in a growing state, leaving little but their seeds or spores. To this cream is added the good seed, the pure culture or starter which contains bacteria in an actively developing condition, and which grow and develop in the pasteurized cream before the spores of the weeds are able to germinate and grow, which insures a good, clean crop of butter flavour.

Some managers maintain that you can improve your butter with the pure cultures, without previously pasteurizing. This can be, but it is like sowing good wheat in untilled ground, the wheat may beat the weeds in growing, but the weeds are more apt to overpower the wheat. The same with the pure culture, the bacteria in the raw cream may be too powerful for the desirable ferments in the culture, by chance possibly the culture ferments may rule the roost.

Pasteurizing improves the flavour of butter, making it clean and sweeter, which, for the British market, is most desirable. It improves the keeping quality, which is the strongest point in favour of pasteurized butter; it will keep about double the length of time of raw cream butter. The latter has generally a higher aroma, but this is incompatible with long-keeping quality. Pasteurized butter has not such a high aroma, but it retains its original flavours for a much longer period.

From the buttermaker's standpoint everything is in favour of pasteurization. The best of buttermakers will admit that they have control over every detail of buttermaking, except the most important part, viz., the ripening of the cream. He can control separating, cooling the cream, churning, and working the butter. Not so in ripening cream. Raw cream contains several different species of bacteria, but what species the buttermaker has no means of knowing, and it is only when the cream is ripe, or the butter made, that he finds out whether the cream did contain something injurious. There is, however, little satisfaction that way.

The people of Great Britain have now learned to appreciate the virtues of pasteurized butter. They have acquired a taste for Danish, owing to its general sweetness, and it behoves the dairyman of Australia to follow the example of the Dane. The sooner our factories



Pasteurizer used in the Glenormiston Factory.

pasteurize and use pure cultures, the better will it be for the dairying industry, because everything will then be under the buttermaker's control. The Danes have shown us what really can be done, and if Australian dairymen will only do likewise, we have nothing to fear. With proper care at the source of milk supply and the factories, we can produce an article second to none. Several factories in Victoria could be mentioned which have had great trouble with their butter during the past autumn and winter, and in which pasteurizing has been introduced with pronounced success, even some of its most rigid opponents admitting to the vast improvement its introduction has made. Some object to pasteurization, because, they say, it coagulates the milk when it is a little sour. Well, it may be said no sour milk should be taken, not if it is merely turned. Some managers assert that it is as much as their billet is worth to return milk. I think it is better for a man to lose his position, than risk the losing of his reputation as a buttermaker. I consider that the directors who would dismiss a manager for refusing to take bad milk, are not fit to manage the business of a dairy company, and are undoubtedly dangerous to the interests of the dairying industry. Milk can certainly be kept sweet enough if the dairyman is careful, and touching his pocket will make him so in a very short time.

Another matter that requires the attention of our factory and creamery managers is the lack of attention given to the skim-milk. There is a great outcry about the hand separator, and doubtless the cause of a great many of our best men resorting to the hand machine is that they have received bad skim-milk at the factory. We will suppose, that a good supplier comes under the milk lift, his milk is everything that can be desired. After him comes the careless man, whose milk is turned ; it is, however accepted, and the good and the bad are mixed together. The mixed milk passes through the separators, the good supplier not only gets some of his own, but also some of the bad stuff. He feeds this conglomeration to his calves, and a large percentage of them die. He naturally begins to grumble, and asks what is the use of his being careful with the milk. He wishes to rear calves for stock, and not getting a sweet skim milk from the factory, he calls to his aid the hand separator, to save his stock. Under such circumstances, he is not to blame, though, I believe, that if the hand separator system were to become rife, the butter industry would be ruined.

The factory managers, however, have it in their power to curtail the use of the hand separator, by paying more attention to the state in which the skim milk is returned to the dairyman. Let more attention be paid to the quality of the milk received. It is unjust that the good milk supplier should suffer for the negligence of the careless dairyman. The manager should see that all utensils in the factory, with which the milk comes in contact, are washed and scalded every day. Some means should be devised for taking the skim milk pipes to pieces more easily. Pipes that have never been taken down for years are bound to be injurious. Means also ought to be provided at every factory whereby the farmer, if he desired, could have his skim milk pasteurized. This I have seen done at one factory in Victoria, several steam pipes are fitted up in the factory yard, the driver has nothing to do but take his waggon up to this pipe, insert the steam hose into the can, turn on the steam, and in less than a minute, he has scalded milk, that will keep for some time if originally sweet. By these means the manager would show the dairyman that he was interested in his welfare, and I believe that in nearly every case the interest would be reciprocated, leading to the general improvement of the dairying industry.

CREAM DELIVERY.

By P. J. Carroll.

Now that the private separator appears to have come to stay, a few words on the importance of a proper system of cream delivery may not be out of place. The export trade of this State was established on a firm basis prior to the introduction for general use of the private separator. The bulk of the butter manufactured at the commencement of the export trade was made from milk received at the factory or branch creamery, where it was delivered daily, separated, and in the case of creameries, conveyed as soon as possible to the central factory, taken charge of by the manager, and placed in a suitable room, the temperature of which was controlled by refrigeraation. Whatever disadvantage this system appears to have had, as is evidenced by the introduction of the hand separator, there is no gainsaying the fact that the factories still adhering to the old system, have continued to make good progress, and have kept in the front rank for quality. The same cannot be said of factories situated in districts where the home separator system has been established.

The introduction of the private separator and its general use, no doubt has had a detrimental effect on the average quality of Victorian butter. There is no wish to attribute this directly to the hand separator, as there are many contributing causes, the principal one being the fact that the use of the private separator has taken away from the factory manager the influence and control he exercised over the suppliers when they delivered their milk daily at the factory, it has also made them independent, and placed them in a position to withdraw their support with the least provocation. Carelessness in the handling and storing of cream on the farm, also the length of time kept before sending to the factory is another of the causes, not a little of the latter being attributable to the unhealthy competition existing between the various factories for the purchase of cream; little or no regard being paid to its condition.

Cream from private dairies is often delivered at the factory in a condition that would permit of a first quality butter being made from it; and on the same day, and at the same factory, cream was received and paid for at the same rate, that was in such state as to be hardly fit for making an eatable butter. This quality it may be added is always churned separately, and the butter sold at from 2d. to 3d. per lb. below normal values, and generally at less than the price paid the supplier for it. If the question be asked why is this class of cream not paid for according to its value, the answer is owing to the competition above referred to. If second quality price is paid, the supplier takes his cream elsewhere, and will do his utmost to induce his friends to do likewise. It does not seem a business transaction to pay more for an article than it can be sold for, but the fact of the matter is the

purchaser does not lose, as the balance, after allowing for wear and tear and profit, is funded and divided *pro rata* amongst the suppliers.

This is an injustice to the careful supplier, who takes a pride in supplying his cream in a good condition, it is also opposed to the best interests of the industry, as there is no incentive given suppliers to deliver their cream frequently, and in a good sound condition, without which it is impossible to maintain a firm grasp of the London trade.

In some factories grading is attempted, and the results are fairly satisfactory, the first grade, however, is usually not up to that of best milk supply factories. When managers are asked why they do not endeavour to fix a higher standard, the answer is that the quantity of really first class cream is so small, that the bulk of their butter, according to their own grading, would be of second or lower grades, so that cream which is truly of second quality is passed in with the few firsts, and all packed under their best brand. It will be seen by this system that instead of bringing the lower quality up to the standard of the first, it has the opposite effect, and lowers the first towards the level of the second quality. Hence the efforts of the clean and careful dairyman go for nothing, and he naturally begins to wonder why he brings his cream three or four times a week to the factory, and is so exacting about the cleanliness of his utensils, the cooling of his cream, and other little precautions that are necessary to enable him to preserve the natural flavour of his cream, when he sees his neighbour, who takes none of the above precautions, and probably does not bother to deliver his cream more than once or twice a week, receiving the same price. This is not the kind of feeling that should be encouraged, far better create and foster a spirit of emulation, wherein every dairyman would be endeavouring to outstrip his neighbour in the quality of cream supplied to the factory.

Under present arrangements such a state of perfection will not be brought about. Butter factory directors and proprietors will have to use a little coercion, and by a rigid system of classification and payment of differential rates, enforce a more frequent delivery of cream. Herein lies the crux of the whole question. If cream from private separators were delivered at the factories at frequent intervals, such as the season of the year demanded, a vast improvement would be made in the quality of the butter produced, inferior and contaminated cream would not be so frequently met with. Fresh cream is amenable to treatment, while age intensifies any existing evils.

Every pound of inferior butter made in the State is a reflection on the intelligence of the producer, as all cream in its initial stage is in a state, under proper treatment, to make a first quality butter, deterioration and consequent depreciation is the penalty of negligence.

The first step to cope with the difficulty under the present system of cream delivery should be a united effort on the part of butter factory owners, to bring about a better system. This may be done by the factories sending out their own waggons, or by regulation, such as in force in the Western District factories, with regard to milk

delivery, which must be sent daily during the export season, a similar rule with regard to cream delivery, say every other day, universally applied, would not inflict hardship on any, and would be of immense benefit to suppliers and factories alike.

In factories situated beyond the range of competition little difficulty is experienced in bringing suppliers under control, and as a consequence the quality of butter made at those factories is of a high standard, the suppliers are getting the benefit of an increased price as a set-off against the little extra trouble, and are as satisfied as suppliers are likely to be under any circumstances.

Some factories are sending out their own collecting waggons, or are arranging for the delivery of cream three or four times a week. From information gained from the managers of those factories, and observations taken at the Government Cool Stores, it can be confidently stated that good results will follow this system, as a distinct improvement is noticeable in the average quality of the butter manufactured, and a higher proportion of the first grades. Previous to the introduction of this system cream arrived at these factories in such an advanced stage of ripeness that it was impossible to treat it scientifically, so as to be able to make a good keeping butter.

I am firmly convinced that the primary cause of the present large quantity of second quality butter coming from private separator factories is the infrequent delivery of such cream ; other defects being intensified by this cause.

In the interests of individual suppliers and the industry generally, I would urge upon dairymen and factory owners the advisability of concentrating all their efforts in the direction of the production of an improved quality of butter, this will result in the return of the maximum value for the labour involved.

DAIRY COW COMPETITIONS.

By R. T. Archer.

Results at Camperdown Show.

A study of the accompanying table should prove of considerable interest to dairymen. The competitors prove to be a particularly fine lot of cattle. It would be still more interesting if the breed of the animal were given. The cow placed 1st this year was 3rd last year. It will be noticed that the cow giving the greatest quantity of milk, viz.: 59 lbs., No. 2, "Iona," exhibited by Mr. W. A. Taylor, is 19th on the list, with a test of 2·4 in the morning, and 3·2 in the evening, and her estimated weekly return works out at 12·66 lbs. of butter as the quantity to some extent makes up for the low test. It would be interesting to test her milk for, say three days in succession, as it is well-known the test of an individual cow sometimes varies from day to day, as is shown in the following instance of a cow, which I sampled myself:—

Fairy—October 31st, Morning, 25½ lbs. test, 4·0; night, 20 lbs. test, 4·8
,, November 1st, ,, 20 ,, ,, 2·8; ,, 20 ,, ,, 4·8
,, ,, 2nd, ,, 20 ,, ,, 3.0; ,, 20 ,, ,, 3·6

	No.	Name of Owner.	Name of Cow.	Morning.	Test.	Butter.	Night.	Test.	Butter.	Total Milk.	Total Butter.	Estimated Butter per week.
				lbs.		lbs.	lbs.			lbs.		lbs.
1	12	Walter Podger	Brindle ..	28¾	4·7	1·519	24	5·0	1·358	52¾	2·877	20·14
2	17	D. McDonald	Possum ..	29	4·4	1·428	19½	5·4	1·198	48½	2·626	18·38
3	14	Wm. Kerr ..	Mermaid ..	31½	3·1	1·066	26	5·0	1·471	57½	2·537	17·75
4	16	D. McDonald	Brownie ..	30	4·0	1·332	23½	4·4	1·156	53½	2·488	17·41
5	20	A. Skene ..	Bid ..	32	3·5	1·235	24½	4·4	1·206	56½	2·441	17·08
6	11	Walter Podger	Yellow Maid	29¾	3·9	1·285	21	4·4	1·034	50¾	2·319	16·23
7	15	D. McDonald	Ada ..	32½	3·2	1·139	25½	4·1	1·162	58	2·301	16·10
8	22	Geo. Fleming	Brindle ..	29½	3·7	1·208	22	4·4	1·084	51½	2·292	16·04
9	4	W. A. Taylor	Bess ..	30½	3·2	1·069	24½	4·4	1·206	55	2·275	15·92
10	13	Wm. Kerr ..	Poley ..	32	3·0	1·046	23½	4·6	1·215	55½	2·261	15·82
11	3	W. A. Taylor	Ladysmith	24	4·6	1·241	17½	5·0	·990	41½	2·231	15·61
12	7	Wm. Perritt ..	Fanny ..	26¼	4·8	1·431	16	4·4	·788	42¼	2·219	15·53
13	10	Walter Podger	Lena ..	32¼	3·2	1·130	25	3·9	1·081	57¼	2·211	15·47
14	21	Geo. Fleming	Ladybird ..	27	3·4	1·010	23	4·4	1·133	50	2·143	15·00
15	8	Walter Podger	Pride ..	23	4·3	1·015	15½	5·9	1·017	38½	2·122	14·85
16	18	D. McDonald	Dina ..	24	3·2	841	20½	5·4	1·260	44½	2·101	14·70
17	5	W. A. Taylor	Veronica ..	28	3·0	·915	23	4·4	1·133	51	2·048	14·33
18	23	Geo. Farrar ..	Daisy ..	22½	3·9	·972	20	4·2	·936	42½	1·908	13·35
19	2	W. A. Taylor	Iona ..	34½	2·4	·933	25	3·2	·876	59	1·809	12·66
20	6	Wm. Perritt ..	Tiney ..	28¼	3·2	·989	20¼	3·7	·819	48¼	1·808	12·65
21	9	Walter Podger	Rose ..	26¼	2·8	·838	21	3·9	·908	47¼	1·746	12·22
22	1	A. Green ..	Poley ..	21½	3·6	·856	17½	4·5	·884	39	1·740	12·18
23	19	W.H.Satchwell	Werna ..	21	4·1	·958	15	4·4	·739	36	1·697	11·87

The system of taking the sample is a distinct advance on that practised formerly when the cows had to be brought to the show ground to be milked, and as many of the best milking cows are the most sensitive

and nervous, they will not do their best amidst strange surroundings and the excitement which is inevitable under those conditions.

The conditions adopted this year were :—

1. The prize shall be given to the cow that gives the greatest quantity of butter, as shown by the Babcock test. Should two or more cows be equal, the prize shall go to the heaviest milker.

2. The competing cows will be milked dry at the owner's premises in the presence of gentlemen appointed to carry out the competition, one of which will attend at each place, at 7 o'clock, on Tuesday morning, 10th November, and will be milked for test at 5 o'clock on Tuesday evening, 10th November, and 7 o'clock on Wednesday morning, 11th November. The milk from the last two milkings will be weighed, and test samples taken in the presence of the owners of the competing cattle. Each exhibitor to supply his own cans and buckets.

3. The competing cows must be shown on Show Day, and competitors must deposit with the Secretary at the time of entry the sum of £1 as a guarantee that they will be shown. The deposit will be forfeited if the cow is not exhibited.

4. The same milkers shall milk throughout the trial.

5. Feeding allowed whilst being milked; if fed, must be fed throughout the trial.

6. Entries close for this class on Tuesday, October 27th, 1903. Prizes—1st, £5 5s.; 2nd, £3; 3rd, £2; 4th, £1.

A sweepstake of 10s. each entry to be paid at time of entry. Ten per cent. will be deducted from the sweepstake money for expenses. The balance will be apportioned as follows :—1st prize-winner, 4s. out of each entry; 2nd prize-winner, 2s. 6d. out of each entry; 3rd prize-winner, 1s. 6d. out of each entry; 4th prize-winner, 1s. out of each entry.

The following is a copy of steward's card :—

DIRECTIONS FOR TAKING MILK SAMPLES.

1. The cow must be thoroughly milked out, and the samples taken from the whole of her yield.

2. As soon as the milking is completed, the milk to be weighed carefully in the bucket, and the weight immediately recorded on the card. The weight of the bucket when empty, to be taken and deducted from the total.

3. The milk must be thoroughly mixed by being poured four times from one bucket into another, before the sample is taken.

No. TEST COW.

WEIGHT OF MILK.

EVENING .....lbs. ..... ozs.
Weight of Bucket.....lbs. ..... ozs.

Nett .....lbs. ..... ozs

MORNING.....lbs. ..... ozs.
Bucket .....lbs. ..... ozs.

Nett .....lbs. ..... ozs.

Total.....lbs. ..... ozs.

Owner's Name .....
Cow's Name .....

Port Fairy Regulations.

The Port Fairy Agricultural Society were the pioneers in this country of the modern system of testing cows in show competitions, and the following are their regulations :—

"Exhibitors when entering, must furnish on their Entry form, age, date, when "calved, and brand of cow.

"Cows to be exhibited in the show grounds, on the 15th October, 1903, but "the milking will be done at the home of the owners on the 6th and 7th October, in "the presence of Stewards appointed by the Society, who will take charge of "the milk to be tested, and who will also attend to see cows properly stripped on "the morning of the 6th October.

"The milk will be weighed and sampled at the evening milking, on the 6th "and morning of the 7th October, and tested with the Babcock Tester.

"One point will be allowed for each pound weight of milk; ten points for "each percentage of butter fat; one point for every ten days over the first 28 days, "and up to 128 days after calving.

"Exhibitors, if called upon, must make a declaration, giving the correct date "on which the cows calved.

"Exhibitors will provide their own buckets for milking.

"SPECIAL NOTE.—Entries for all Test Prizes to be in the hands of the "Secretary not later than Thursday, 1st October, 1903, at 3 o'clock p.m."

This is a very good system, and the clause providing for a declaration to be given as to correct date of calving should be a sufficient safeguard against fraud.

Some cows are very persistent milkers, and when well fed, will milk, if allowed, right up to calving again. These are more profitable than cows which give a big return for a few months, and then dry off, and by giving points for the length of time after calving, they have a legitimate chance in a competition.

The following is a copy of the card to be exhibited on the pen of the cow on the day of the show.

PORT FAIRY AGRICULTURAL AND PASTORAL ASSOCIATION.

Entry No 10 Fed on ordinary pasture

Test Cow

Owner, Mr. J. C. Ritchie.

Breed—Shorthorn. Age 9 years. Days Calved, 91 days.

Milk Yield.		Total.	Test.	Butter Computed.	Points Gained.			Total Points.
Morning.	Evening.				Calving.	Milk.	Butter-Fat per cent.	
25 lbs.	25 lbs.	50	3·6	1·98	6·3	50	36	92·3

British Dairy Farmers' Association.

The scale of points allowed by the Association is as follows :—

One point for each 10 days since calving, deducting the first 20 days, and with a maximum of 18.

One point for each pound of milk yielded in 24 hours, average of two days taken.

Twenty points for each pound of butter-fat contained in the milk.

Four points for each pound of solids, not fat, contained in the milk.

Ten points deducted from the total score if the milk contains less than 3 per cent. of fat.

In this, it will be seen that the British Association have gone a stage further than we have in taking the tests for two days, and this, I think, is worthy of consideration, as it would minimise the effect of the daily variation which we have noticed above. We need not attach much importance to the allotments of points for solids, not fat, as that runs in almost exact proportion to fat, except when the fat is over 5 per cent. when the portion of non-fatty solids is slightly reduced, and if we find the value as a butter producer, we know it is practically the same for cheese. Many people may say, it would be too much trouble to take a two-days' test, but it is only once a year, and considering the importance of it, and the increasing interest taken in the tests, it is worth considering. As it is, the country societies have set an example that may well be followed by the Royal Society of Victoria, as the milking competition as conducted at their annual show, is of very little educational value, and considering the importance of the industry, this competition might well be conducted on more up-to-date lines.

One good result from these competitions should be that it will induce more farmers to get testers and test their own cows, by which means they will find out which are not paying for their keep, as in a case I came across this week of a cow giving 2½ lbs. of butter a week; these will be culled, and thus the general average for the State increased very considerably.

THE DAIRY COW.

Shape.

It is a question how far the conformation of the Jersey cow has lent itself to the spread of a widely held opinion that a cow, to be a typical dairy animal, must be narrow chested and thin fleshed. The breeders of Jersey cattle, breeding solely for quantity and quality of milk, after long and careful selection, have no doubt become possessed of a class of dairy animals superior in these respects to any other known breed. In furtherance of their work in the development of a rich milk producing animal, and the whole attention of the Jersey cattle breeders being given to the one object, their cattle have little to recommend them to breeders who must necessarily aim at producing stock of a general purpose character. Had the Jersey cattle breeders, with their careful and systematic attention to details, for which they are famous, found it to their advantage to have produced larger framed general purpose animals, there can be little doubt but that equally good results, so far as milk is concerned, would have been attained. The production of butter suited the position of farming in their isolated position, hence their attention to a special purpose breed of cattle. To those who feel inclined to question this it may be said that there is clear evidence that the greatest care has been exercised for generations by Jersey breeders in selection and mating their cattle, so as to develop the quantity and quality of milk, while on the other hand no such careful and united action can be traced on the part of Shorthorn breeders. Until we have evidence to show that systematic and practical efforts have failed in producing a wide-chested, broad backed, deep and rich milk-yielding class of cows it cannot be claimed to be an impossibility to do so. Even with the small attention that this subject has received from breeders, we have direct evidence of what can be done in a few years by those who, never losing sight of wide chests and broad backs, select their breeding animals with the assistance of carefully kept records of the quantity of milk produced with its percentage of butter fat.

Fat and Flesh.

With regard to this matter it is absolutely necessary to distinguish between flesh and fat, a distinction which even amongst cattle breeders would seem to be a matter of uncertainty and doubt. Full muscular or flesh development can doubtless go hand in hand with deep milking, but excessive fat development means absence of milk. To many who fail to distinguish between flesh and fat, a deep, round body suggests high feeding and small milking powers; while a fleshless, although fat animal, is often termed "a lean, milky looking subject." There is one infallible test in such cases, a test employed by butchers when purchasing animals for the block. It is trying the thickness of the flank, or lap, as it is termed in many parts of

Ireland. In applying this test it will often be found that an animal spoken of as lean seems so from a want of flesh, the flank handle being all that one would expect in highly fed animals. This flank test cannot be too strongly advocated, seeing it is perhaps the only one which can be depended upon to discriminate, with any degree of certainty, between fat and flesh in a living subject. Were it more generally applied the credit accorded to many apparently lean animals would be less pronounced. Flesh and milk can, and do, go together, and this being so it is all-important from the point of view of constitution and health in our animals that this is kept in mind. An animal's strength depends upon its muscular development, and it is unreasonable to expect strong, healthy progeny from weak, fleshless, though perhaps fat, parents.—Robert Bruce, in *The Journal of the Department of Agriculture for Ireland.*

VICTORIAN PRODUCE IN LONDON.

By A. G. Berry.

Butter.

Since writing on the 16th ultimo, the R.M.S. "Himalaya" and the R.M.S. "Orient" with small consignments, and the R.M.S. "India" with 5,626 boxes, have arrived.

The butter by all the above-named steamers has been delivered in good condition. Some of it is new season's butter, the quality of which is excellent. It is selling readily at 106s. to 108s. per cwt., and the firms here connected with the trade are very hopeful, if the quality of future supplies is maintained, that Victorian butter will again reach the position in the trade that it held previous to the last two seasons. Australian butter is practically on its trial again, and the necessity of keeping up to the standard started cannot be too strongly impressed upon the Victorian butter manufacturers and shippers. If the good quality is maintained throughout the season, the difficulty of inducing shopkeepers and others to buy Australian butter instead of other butters on the market next year will be greatly diminished. Owing to short supplies from Australia during the last two years, many original buyers of our butter have had to purchase other kinds, and it is no easy matter to persuade them to again trade in Australia unless the quality is good and the price moderate.

As regards the old season's butter, of which large quantities are still in cold store here, I regret to say that sales are very slow. Prices range from 86s. to 92s. per cwt., at which prices buyers consider Siberian better value at present. However, shipments of the last named are decreasing and becoming poorer in quality, so that there is hope that a better market will be available for second rate Australian butter shortly. There is little doubt that some of the stored butter is very poor—in some cases quite rancid.

Prices for the week are as follows :—Danish, 120s. to 122s. per cwt.; Russian, 80s. to 94s.; Australian (new season's), 106s. to 108s., and 110s. for very special; stored, 86s. to 96s.; New Zealand and Canadian, 100s. to 104s.

Rabbits.

In continuation of my memorandum of the 16th ultimo on the above subject, I have to report that I proceeded to Liverpool, as instructed, to inspect the rabbits consigned to that port by the s.s. "Persic."

There was a good deal of delay in opening the chambers containing the rabbits, as the vessel arriving in dock on Thursday night, the consignees requested that delivery should not be made to

them until the following Monday. On that day I inspected the rabbits and the chambers, and found everything satisfactory.

During my stay in Liverpool I called on Sir Charles Petrie and Mr. Ruddin, the two large Liverpool importers of Australian rabbits, and I was received with every courtesy. I had a long talk with the first-named gentleman relating to the rabbit trade, and there is little doubt that for the northern and north midland trade in rabbits (which is very large), Liverpool, from its geographical position, and consequently lower railway rates, is in a better position than London to cater for the trade. The present difficulty in furthering this is the question of direct shipments to Liverpool from Australia. There are at present practically no boats going direct to that port from Australia. The White Star steamers go there, but they call first at London, and do not arrive in Liverpool until nine to eleven days later. If goods are urgently required, it becomes necessary for consignees to take delivery in London—although the goods are consigned to Liverpool—and forward by train rather than wait for the steamer to arrive in the ordinary course at Liverpool. This is probably not done to any large extent, but I mention it as showing a difficulty of increasing our trade in the populous districts of the north.

The R.M.S. "India" discharged 2922 crates of Victorian rabbits in excellent condition this week, and the s.s. "Narrung" 1606 crates—is now discharging. I hope to be in a position to report on the condition of the latter consignment next week.

The trade in London in Australian rabbits is very quiet this week, as supplies of English are plentiful. The top price for Victorian to-day is 15s. 6d. per crate ex ship.

Grading Rabbits.

I also desire to bring before the authorities in Melbourne the opinion of the chief importers, that the rabbits are over graded. At present there are six distinct grades:—"Large," "Young," and "Small," in black and red. That is to say that there are two grades of "Large," two of "Young," and two of "Small." The opinion of the trade now is that these are too many, and only lead to confusion. The words "first quality" and "second quality" also are rather likely to be inferred by buyers as meaning an inferiority of quality or condition in the rabbit itself. This, I take it, is not what is intended, as I understand the words "second quality" to refer to the size of the rabbit only. I would therefore recommend that the rabbits in future should be graded into three classes only, viz.:—"Large," "Young," and "Small," and that use of the words "first quality" and "second quality" on the crates should be discontinued. The stamp of the Agricultural Department, "Approved for Export" is most valuable to the trade, and should naturally therefore be continued.

SEASONABLE WORK FOR THE CELLAR AND VINEYARD.

By P. A. Wyatt.

January.

Cellar.

As this month is always one of our hottest, care should be taken to keep the temperature of the cellar as cool as possible. Opening the doors and ventilators during the night, and closing them in the early morning, will tend to effect this.

As the third racking should be completed before this month, unless absolutely necessary, leave the wine alone, except to see that the casks are kept full to the bung.

Where wines are inclined to "turn" or "go off," rack into clean, well-sulphured casks, and fine; when it becomes bright, rack again. Where it is possible these wines should be sterilised.

Vineyard.

As the season is conducive to the development of black spot and oidium, care should be taken to examine the vines for these diseases, and should they appear, treat with Bordeaux mixture (summer strength) for the former, and sulphur for the latter. Keep the land well stirred so as to retain all the moisture possible. Where irrigation is applied, it should be completed early in the month, and the land well worked directly afterwards.

February.

Cellar.

The inside of the cellar should be whitewashed with fresh lime-wash, and everything thoroughly overhauled that will be required for the vintage that is now approaching.

Wash presses, crushers, elevators, coolers, pumps, &c., with boiling water, to which 10 per cent. of sulphuric acid has been added, so as to destroy any moulds or bad germs that may be on these articles. Casks that are found to have a bad or foreign smell (mould, sour, putrified lees, or bad spirit), treat with the following mixture, recommended by R. Dubois, in the "Agricultural Journal" of the Cape of Good Hope:—

Common Salt, 2 ozs.
Powdered Peroxide of Manganese, 1½ ozs.
Sulphuric Acid (concentrated) 3½ ozs,
Boiling Water, ½ gallon
(This is sufficient for a hogshead.)

Pour the ingredients into the cask, and bung securely, shake a little, and let it remain still for three hours. Rinse with cold water until it comes out bright and without smell.

It may, perhaps, be found necessary to repeat this operation, but it is most effective.

Where wooden fermenting vats are used, after tightening the hoops, put into each about one foot of lime water, keep this well stirred, and rinse round the sides at least twice a week. Before using these vats, wash with hot water and 10 per cent. sulphuric acid, then rinse with cold water. Keep the cellar cool in the same manner as referred to last month.

Vineyard.

Test the sugar-strength of the grapes at short intervals, so as to know when they are sufficiently ripe to start wine-making.

Where the grapes are backward in ripening, clear the leaves from round the bunches; keep the surface of the ground loose.

The second disrooting of roots growing from the scions of the season's grafts should be attended to early in the month.

COLD STORAGE OF FRUIT.

The *Experiment Station Record* for May, 1903, gives a summary of the results thus far secured in the cold storage experiments conducted by the U.S. Department of Agriculture in reviewing the account of them prepared by G. H. Powell. It appears that "in a comparison of the keeping quality of apples picked when nearly grown, and still under-coloured, with larger, more highly coloured, but firm fruit picked two weeks later, it was found that the more mature apples kept just as long, were as durable on removal, were superior in quality, and worth more than the fruit picked while still immature. The most striking differences between these two grades of fruits were shown in their relative susceptibility to apple scald, the immature fruits being much more susceptible to this trouble than the more mature fruits. As a prevention of scald it is recommended that only well-developed, highly coloured fruit be stored, and that this be placed as soon as picked in a temperature not above 32 degs. F., and removed from storage before the scald begins.

"Like results were obtained with Kieffer pears picked at different degrees of ripeness, the more mature fruit keeping fully as well as the greener fruit if placed quickly after picking in a temperature not above 32 degs. The best results with peaches were obtained when the fruit was fully developed and highly coloured but still hard when it entered the storage room. Peaches in any way soft were found to break down quickly on removal, while greener fruit was inclined to shrivel.

"Delay in storage after the fruit was picked injured its keeping quality. When Bartlett pears were delayed from two to four days before being stored they ripened within two or three weeks, while fruit stored immediately after picking was finer at the end of five weeks. Kieffer pears stored immediately in a low temperature kept in prime condition until April. When storage was delayed ten days they showed softening and discolouration at the core in about thirty days. Delay in the storage of apples, more particularly the long-keeping sorts, was not found to be so serious as with the other fruits; nevertheless much delay in storage does not in any wise improve the keeping quality, and whenever the climatic or other conditions are such as to hasten the ripening of the fruit delay in storage is harmful. The author considers it much better to leave the fruit on the tree until it can be put in cold storage, rather than to pick and store it in the orchard or cars.

"Relative to the temperatures at which the various fruits keep best it was found that 32 degs. was better for both apples and pears than any temperature higher than this. Kieffer pears, for instance, stored in a temperature of 32 degs. kept until April, while at 36 deg. they reached their commercial limit in December. Peaches also kept

better at a temperature of 32 degs. than at any temperature higher than this, and the quality of the fruit was equally as good. The ability of all the different fruits to stand up when removed from a temperature of 32 degs. was far greater than from any temperature higher than this. The general impression that cold storage fruits lack quality and deteriorate quickly when removed from cold storage has been found to be fallacious.

"Wrapping fruit in tissue, parchment, paraffin, or newspaper has been found to prolong the storage season of winter apples and late-keeping pears; preserving their fresh appearance, preventing accumulation of mould on the stem or at the calyx, lessening the decay, and preventing evaporation from the fruit. Little difference was noticeable in the efficiency of the different wrappers. It is believed that with all fancy fruit for long keeping, wrapping is worthy of commercial consideration.

"As to the effect of different kinds of packages on the keeping quality of fruit it was found that the smaller open packages, which permit of ventilation and rapid cooling down, are better than larger packages like barrels, in which the fruit in the center is likely to maintain a considerably higher temperature than the outside fruit, and thus undergo a ripening process which hastens decay."

THE ORCHARD.

By Jas. Lang.

Seasonable Work.

This has been one of the best seasons experienced by orchardists for very many years past, the splendid rains which fell during the winter having thoroughly saturated the subsoil. Not for some years has the subsoil received such a soaking as it has this winter. Fruit trees are now making a healthy and vigorous growth, and look better than they have done for a long time. It will be necessary to keep the scarifier going to keep down the weeds and prevent the soil from becoming caked. Keeping the surface loose also conserves the moisture in the soil by preventing evaporation.

The codlin moth will have to be attended to by spraying, and examining the bandages every week. The season being cold and damp, the moths have been much later in making their appearance than usual, and should the weather remain cool it is possible that not more than one brood will mature during the summer. If this should be the case it will be a great relief to orchardists who have suffered far more loss from the second and third broods than from the first. It therefore behoves all orchardists to bestir themselves and take advantage of the favourable season to destroy as many as possible of the grubs, and thus lessen the number for next year. A spraying should be given early in January, and another early in February, and should the grub be prevalent still another about the middle of March would be of advantage. It was observed last year that apples gathered into the store during the latter part of April must have had the eggs attached, as young grubs were developed for some weeks afterwards.

Where it is desired to propagate young trees, or renew old ones, the month of February will be the most suitable to bud them. It is too late now this season to top the leading shoots on young fruit trees, but superfluous shoots may be thinned out, and thus the work of winter pruning lessened.

Export of Apples.

As the export season for apples and pears will soon be round, it will be well to remind growers and shippers that it will only pay to export the most suitable varieties for the English market, viz., Cleopatra, Munro's Favourite, Jonathan, Rome Beauty, Esopus Spitzenburgh, and Newtown Pippin. Growers sometimes take up more space than they are able to fill with the best sorts, so that they have to make up their quantity by sending those that only realize a moderate price in the London market, thus bringing down the average of the whole consignment. It is therefore more profitable to send a

smaller quantity of the best varieties than large consignments of sorts not so suitable. The London buyers are very conservative, and will only pay a good price for varieties that are well known in the market as of the best quality.

Pears for Export.

In the July number of the *Journal* appears a report from Mr. J. M. Sinclair regarding the best pears for the English market. He mentions the variety Doyenné du Comice as being largely shipped from California. This is a pear of the very finest quality, but in Victoria it is a very poor bearer, and as a commercial pear not worth growing. The writer has had several trees of this variety in his orchard for many years, but has never obtained a crop from them.

Pears for export are best packed in trays in single layers. The most successful consignments last year from Harcourt were packed in trays, and Mr. J. B. Thomas, of Covent Garden, reports "that it was the most satisfactory system of packing pears that had come under his notice," and advised future consignments to be packed in the same manner. The size of the trays, inside measurements, is 3 inches by 14 inches by 18½ inches; three trays are placed one on top of the other and fastened together at each end by two cleats, the lid is then nailed on, and the whole forms a neat package about the size of the usual export case. Winter Nelis packed in this way sold for 10s. 6d. per tray, 35 fruits in each tray, last season in Covent Garden.

THE VEGETABLE GARDEN.

By Thos. W. Pockett.

During January, February, and March, preparation has to be made for the autumn and winter supply of vegetables, and owing to the crops maturing so quickly during the hot weather, there is usually plenty of land lying idle at this season. When it is intended to plant cabbage or cauliflower during, say February, this land would be greatly improved if it were now dug deeply, and where practicable a good dressing of manure worked in. When the time for planting arrives it should again be forked or dug, plants will then take root much better, will require less water, and there will be better results generally.

In the Melbourne district seeds of the following may be sown during January and February :—Brussells Sprouts ; Cabbage, summer varieties, such as St. John's Day, to be followed with winter varieties, such as Savoy, Enfield Market, &c. ; Cauliflower, starting with early sorts, to be followed by Chandler's Mammoth, or other late kinds. A supply is then assured from, say April, until July. The plants should always be watered before taking them from the seed beds, and if possible be planted out when rain is near at hand. Celery seed may still be sown in small quantities, and plants should be put into trenches, or planted in ground that is heavily manured. The self-blanching varieties need not necessarily be planted in trenches. The object of the trench is to give soil for earthing, so as to cause the leaves and stems to become white, but many people now adopt other methods, such as placing four-inch pipes over the plant, or strips of sacking, or brown paper will do equally well when wrapped round the plant, with a couple of ties to keep it in position. The plants should be from 12 to 18 inches in height before applying either, and whatever is used it should not come more than half-way up the plant. The pink varieties are generally rather more solid, and slightly hardier than the whites, and may be chosen for the later crop. If extra large sticks are required, it will be necessary during the growing season to give liquid manure once, or twice a week—nitrate of soda, about half-ounce to one gallon of water will also be found beneficial. Seeds of Carrot, Parsnip, and Beet may be sown, which will come in for use in the winter and early spring, when many of the earlier sown crops will be going to seed. Turnips are uncertain until end of February or March. French Beans may be sown until middle of February with success, after that date they would be uncertain, as the cold weather may check them, although sometimes a chance crop may be obtained in May, from seed sown the beginning of March.

Tomato plants should receive attention, removing any superfluous growths. The free-setting heavy croppers should have all small

growths removed, and any assistance, such as water or liquid manure, so that the fruit may be properly developed before the nights get too cold. The strong growing and shy bearing varieties will need to be thinned out, and where a bunch of fruit is setting, the growth should be nipped back to within one joint of the flower, otherwise they are liable to make too much growth at the expense of the fruit.

These notes refer to the Melbourne district, warmer districts may be a little later, while colder districts may be a little earlier.

THE FLOWER GARDEN.

By Thos. W. Pockett.

Tying, staking, watering, and manuring should be the chief work for the next two months, beyond the general hoeing and stirring of the soil after watering, or to admit water.

Cannas should be looked over, removing old leaves and flowers, and with a little assistance in the shape of manure and water a glorious display will be assured during autumn. Dahlias that remained in the ground last winter, and reflowered during the early summer, may be cut down to the ground early in the month, so as to get fresh growth, which will flower during March, April and May.

Chrysanthemums that have been allowed to grow from stools may also be cut down, unless large blooms are required, and in such cases young plants put out in September or October would be best, and any shortening should have been done not later than the middle of December.

Any bare places in the borders, caused by flowers or plants that have finished blooming, may be filled up for the autumn.

For a number of years past I have sown Cosmos, Marigold (French and African), Zinnias, and Variegated Maize, at the beginning of January. They generally come up with little trouble, and by the time they commence to flower the weather is cool, and a fine display is produced with practically no trouble, and there is the advantage of the flowers lasting longer, whether cut or on the plants.

Roses.—The autumn display of roses is generally the best, more especially with the Teas, and Hybrid Teas. All old flowers should be cut away, and any bushes making unnecessary growth should be thinned out, and if the rainfall is deficient about March give a good watering, or, what is preferable, liquid manure.

Lawns.

Buffalo grass lawns may still be made until March or April. When it is intended to grow other grasses with the Buffalo, nothing is so good as Kentucky blue grass. I generally have a patch ready, and dibble a piece in about every foot when planting the Buffalo. The one leads during the summer, while the other is green and fills up all the available space during autumn, winter and spring, yet the one never kills the other, or becomes patchy.

EARLY BLIGHT OF THE POTATO.

(*Alternaria solani (E. & M.) Jones & Grout.*)

By D. McAlpine.

Nature and Symptoms of the Disease.

Potatoes are subject to a number of diseases, but fortunately *the* potato disease which is so destructive in other countries has not been found in Australia. This disease, which affects all parts of the plant, leaf, stem, and tubers, is often known as the Late Blight, because it does not usually appear until comparatively late in the season.

But there is another known as the Early Blight, on account of its appearing just when the tubers begin to form, or even earlier, if the conditions are unfavourable to healthy growth, and it only occurs upon the leaves and stems, not causing the potatoes to rot as in the other.

It first came under my notice in April, 1896, at Leongatha, and since then at other parts of South Gippsland; but although not very generally observed as yet, this is probably owing to its being unrecognized. The accompanying reproductions of photographs will enable any potato-grower to make sure of its presence and thus to take action in getting rid of it. This disease causes serious loss in the United States, where it was first definitely determined in 1891, and it is widely distributed in Europe, as well as in New Zealand, and has recently been discovered in India, where, however, only a few fields were found affected. There is no mistaking this disease when fully developed, although it might possibly be confounded with early maturity and thus escape notice. The stems are hard and woody and of an unhealthy hue, while the leaves are brown and withered, somewhat of the colour of tobacco. Owing to this the entire plant finally withers and dies before its proper season, thus causing the tubers to be small, only one-half or one-third their usual size. The tubers, however, are sound, although undersized and immature, and the fungus evidently has no direct affect upon them, as is the case with the Late Blight.

While closely investigating the disease at Leongatha I found that every kind of potato was affected, whether grown in virgin land or not, and irrespective of being grown in any of the three classes of soil found in the district—chocolate, grey loam or black loam, the latter being situated near the creeks and rivers. The average rainfall is about 40 inches, so that there is abundance of moisture, and it was noticeable that the diseased plants produced no fruit, or plums as they are called. When the disease is followed from its earliest stages it is found that the leaves have dark-brown, well-defined, rather irregular spots, which increase in number and size until they overrun the entire leaf and destroy it. (Figs. 1 and 2). If the irregular spots

G. H. Robinson, Photo.

EARLY BLIGHT OF THE POTATO.

(*Alternaria solani, Jones & Grout*).

are closely examined they are found to be usually marked by concentric rings, which indicate the stages of growth in the spreading of the spot. Ultimately the leaves become wholly brown on their upper surface, although the under surface retains more or less of a green tinge. The stalks are also of a sickly yellow, instead of a bright, healthy green, and latterly lose their succulence, becoming dry.

The Fungus under the Microscope.

If one of the spots is examined under the microscope it is found to be permeated by fungus filaments, which cause the decay of the tissue. and from these, dark-brown erect or ascending filaments with transverse partitions project and bear the reproductive bodies. The filaments which ascend into the air are called conidiophores or conidia bearers, because they give rise to conidia at their free ends, which are slightly cup-shaped so as to form a resting place for the conidia. (Fig. 3). These brown conidia are the reproductive bodies, and each consists of a number of compartments divided lengthwise and crosswise and terminates in an elongated, slender, colourless, tapering beak with cross partitions, the beak being single, double, or treble. (Figs. 4, 5, and 6).

When ripe these conidia are easily detached, and under the influence of moisture soon begin to germinate. They do this in a variety of ways, the great difference being in the more or less direct and rapid way in which they reproduce themselves.

The conidium may directly produce on its beak a short conidiophore (Fig. 7) which in turn bears a conidium, the one shown in Fig. 4 having fallen from it, or various lateral conidiophores may be formed, giving rise to secondary conidia (Figs. 10 and 11). The terminal beak may produce a germ-tube, which bears a conidophore and secondary conidium. (Fig. 12). All these methods shew how rapidly the conidia may be multiplied without the intervention of much of a vegetative stage. But under normal conditions when a conidium falls on a moist spot on a leaf, various cells may put forth delicate filaments, which enter the stomata or breathing pores and thus produce the mass of filaments from which conidiophores arise, as in Fig. 3.

It can easily be seen how the fungus spreads, and on the dewy leaf reproduces itself with amazing rapidity.

An extensive series of cultures on potato leaves, in water and in decoction of potato leaves, was carried out by my assistant, Mr. Robinson, in order to observe the methods of spore formation and germination. The diseased leaves received at the laboratory as a rule showed only a limited number of conidia. On placing small diseased spots in petri dishes and keeping them moist, in twenty-four hours a profuse development of conidia was noted, and in the many hundreds of such cases subjected to the most careful microscopical examination, no single instance of the production of conidia in chains was observed. But in old cultures in potato leaf decoction, a few chains of conidia

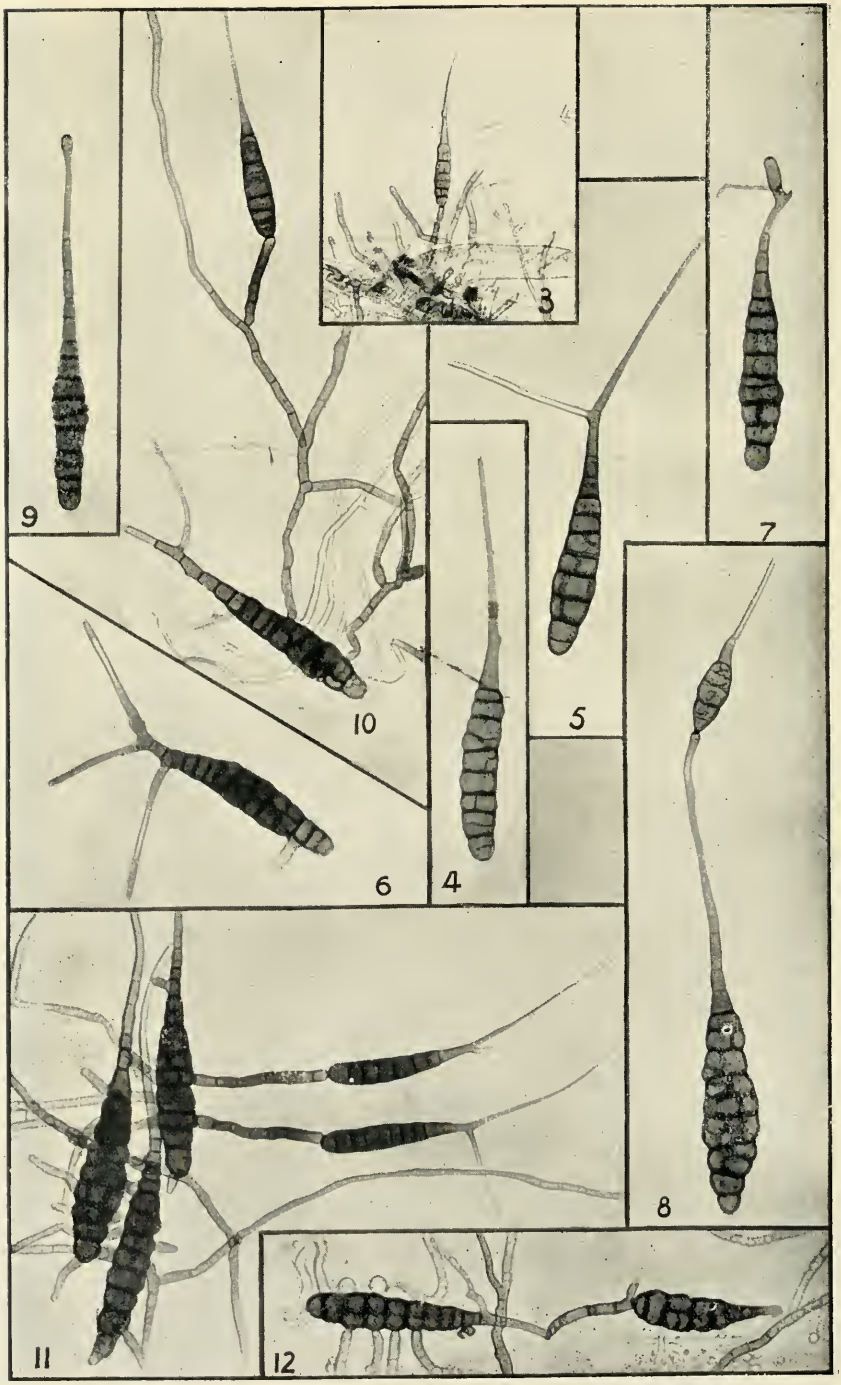
were met with. In such cases, however, it was readily seen that the *normal* conidium, with its *tapering* beak, became modified in such a way that the ultimate segment of the beak became cup-shaped and bore a secondary conidium at the apex. Jones and Grout in America were the first to note these chains of conidia, but they failed to draw attention to the modification in the form of the beak of the conidium, necessary before the chains could be formed. It is a nice point to settle whether the fungus concerned should not be more properly termed a *Macrosporium*, as named by the original describers, or an *Alternaria*, as suggested by Jones and Grout. The matter is mainly one of scientific interest, but since the normal habit of the fungus growing under natural conditions as a parasite is to produce its conidia singly and not in chains, it seems that the balance of evidence is in favour of the former name. No record has, so far as I am aware, been made of the occurrence of chains of conidia growing naturally upon potato leaves.

The difference is very striking between the normal tapering beak of the naturally formed conidia in Figs. 3, 5, and 6 and the conidia with cup-shaped extremities produced under artificial conditions, as in Figs. 8 and 9.

Treatment.

In certain parts of Gippsland this disease has been a standing grievance with potato-growers for a number of years, and the only explanation they can offer as to its occurrence is that the seed has run out, and the evident remedy is to get new seed from another district. It is not considered safe to plant the same potato seed for more than two seasons, and even in the second season there may be a considerable loss, even as much as 20 per cent. I examined a number of fields under similar conditions and found considerable variation. In one field which produced six tons of good, sound tubers the previous year, in the following year the growth was very unsatisfactory, as from their first appearance above ground the stalks were weak and sickly, and a number never came up at all. In an adjoining paddock, where the soil was similar and the new seed potatoes planted the same week, and for the first time, the produce was at the rate of 11 tons per acre, without misses, and the plants all strong and healthy.

The growers in this district have found out by dear-bought experience, that it is necessary to have fresh seed every season at least, but they have no idea as to why this is useful in checking the disease. I take it that since this particular fungus is what is known as a weak parasite, it can only do serious damage when the vitality of the plant is lowered from some other cause. The plant from fresh seed resists the disease, because it is more vigorous in its growth, and less likely to let the fungus gain a footing in its tissues. Therefore, the first recommendation is to adopt all those measures which tend to produce a healthy and vigorous plant, such as thoroughly-matured seed from a clean district, deep ploughing, manure where necessary,



G. H. Robinson, Photo.

EARLY BLIGHT OF THE POTATO

(*Alternaria solani, Jones & Grout*).

and thorough tillage. Another evident precaution is to destroy all the diseased plants, so that the fungus may not be allowed unchecked to propagate itself and sow its reproductive bodies in the soil.

There is yet another remedy to be mentioned, which has been extensively employed in the United States, where the disease seems to be worse than in other countries, and that is the use of the well-known fungicide, Bordeaux mixture. The orchardist has to spray his apple and pear trees for black spot if he wishes to save his crop from being ruined in a spotty season, and the potato-grower seriously threatened by the Early Blight, will find it to his advantage to spray likewise. If spraying is to have its full effect, it must be done early, for in diseases of this nature, he must anticipate the attack, and not wait until he sees the plants succumbing to the disease. Since, no doubt, the conidia are in the soil, and attack the plant early, it would be advantageous to treat the soil immediately before planting, and when the plants are about six inches high. The formula known as 6.4.40 or 6.4.50, may be recommended, and it has been found that spraying at the rate of 100 gallons per acre, gave better results than 50 gallons per acre.

Explanation of Plates.

(*Alternaria solani.*)

1. Young leaf of potato affected by the Early Blight, showing the formation of small discoloured spots. (Nat. size).

2. Mature leaf of potato, showing large dry spots due to the growth of the fungus. (Nat. size).

Conidiophores and conidia of the fungus growing on the leaf, as seen under the microscope, when magnified 100 diameters.

4, 5, 6. Conidia with one, two, and three beaks. (× 250).

7. Conidium with one beak, upon which a cup-shaped conidiophore has been formed, the conidium shown in fig. 4 having fallen from it. From a culture on potato leaf decoction.

8. Chain of two conidia, in the larger the single terminal beak has become modified so as to serve as a conidiophore, being terminated by the characteristic cup-shaped apex. From a culture on potato-leaf decoction.

9. Conidium showing the modification of the single terminal beak into a conidiophore, with the cup-shaped apex. From a culture on potato-leaf decoction.

10. Conidium germinating in decoction of potato leaf, showing the formation of mycelium, in turn giving rise to a conidiophore and conidium.

11. Conidia germinating in decoction of potato leaf, one of them producing two coniodiophores, each bearing a conidium with two beaks.

12. Conidium germinating in potato-leaf decoction, a secondary conidium being formed at the apex of the conidiophore arising from the terminal beak.

NOTE.—Figs. 1 and 2 natural size, Fig. 3 magnified 100 diameters, and all others magnified 250 diameters. All figures reproduced from original photographs and photomicrographs, by G. H. Robinson.

A FUNGUS PARASITE ON THE CODLIN MOTH.

(Isaria farinosa (Dicks.) Fr.)

By D. McAlpine.

Early in October, when carrying out spraying experiments in Mr. A. F. Thiele's orchard, at Doncaster, that grower called my attention to the fact that numerous codlin moth grubs were being killed by a white fungus that enveloped them. He calculated that as many as 90 per cent. were destroyed in this way, and considered the disease to be of the nature of an epidemic. The zinc bands around the tree-trunks were being removed and examined at the time of my visit, and I obtained a number of dead specimens in order to examine the fungus which appeared as a dense, woolly covering around the bodies of the larvae. In some cases the fungus grew out from the body in the form of slender stalks, expanding at the free end, and in one instance three such stalks were observed about 10 mm*. high, and ending in a club with a white mealy covering. On examining this white material under the microscope, it was found to be a mass of fungus filaments, with numerous projecting Penicillium-like bodies, bearing innumerable spores or conidia as they are technically called, which was the cause of the mealy appearance. The dense, white mould directly covering the grubs, did not show at this stage any of the reproductive bodies. Several of the grubs were placed in damp chambers, not however so moist as to encourage the growth of other fungi, and in about five days there was a profuse development of conidia. The fungus might either be chalky-white or ochraceous, or a mixture of both, but the conidia produced in each case were the same, showing that the fungus varied in its colour. At various points, short, thread-like stalks were produced, and it was soon decided that the conidia might either be produced at the tips of these stalks, or directly from the fungus filaments enveloping the body. Here, then, was an undoubted fungus attacking the codlin moth grubs and destroying them at the stage when they were about to pass into the chrysalis form. It was also found to be capable of reproducing itself freely, and thus a means of spreading the fungus was easily obtainable if it should be found practicable to destroy the codlin moth in the grub stage by this means.

Previous Records of Parasitic Fungi on the Codlin Moth

The codlin moth, like others of its class, has many natural enemies, and these have all received more or less attention at the hands of investigators. T. D. A. Cockerell† in "Preliminary Notes on the Codlin Moth," has pointed out its natural enemies occurring in New Mexico, and these include:—1, birds; 2, bats and other

*A Millimetre is about $\frac{1}{25}$ inch. † Bull. 25, New Mexico, Ag. Exp. Sta., Feb., 1898.

vertebrate animals; 3, hymenopterous parasites; 4, a beetle larva, and 5, a parasitic fungus. It is with the latter that we are more immediately concerned, and considering the importance of the subject, his remarks are quoted in full.

"On November 4th, 1896, two dead codlin moth pupae were found on a tree, both attacked by a fungus. Later on, a worm was found in a mummified condition, its death apparently the result of a fungus growth. Still further search showed that a small per centage of the mature worms, and also of the pupae, perished in this way, but the disease was not prevalent enough to be of much importance.

In April, 1897, in Mesilla, many worms which were kept in a bottle died from the attack of the same fungus, which had all the appearance of the celebrated chinch-bug fungus, *Sporotrichum globuliferum.* Specimens were sent to Dr. R. Thaxter for a critical opinion, and he replied that the fungus seemed to him to be *Sporotrichum globuliferum.*"

This is the first and only definite record that I am aware of as to the occurrence of a parasitic fungus on the codlin moth.

In September, 1899, Mr. Cock, orchard inspector, sent me dead grubs from the Castlemaine district, enveloped in fungus filaments, but since there was no fructification present, the fungus could not be determined.

Nature of the Fungus found in Victoria.

The general characters of the fungus have already been given, but a more detailed account will be necessary to settle its systematic position. The fungus filaments, which are about 3 microns* broad, either directly envelop the body or grow out into compact, interwoven threads, forming a slender stalk often expanded at the free end, and the upper two-thirds has a white mealy covering composed of innumerable colourless conidia. Directly from the filaments covering the body, or from the threads composing the stalk, there arise the conidia-bearers which resemble those present in the common blue mould on rotting fruit, &c.—a *Penicillium*; that is to say, there is a long, slender filament, variously branched, often in whorls, and at the end of each there are flask-shaped basal cells or sterigmata, which bear the conidia in long chains. The conidia are colourless, subglobose, or, shortly oval, very minute—$2\frac{1}{2} \times 1\frac{1}{2}$ microns. The characters are those of the mould known as *Isaria*, and the form agrees very closely with *Isaria farinosa* (Dicks.) Fr., or Mealy Isaria.

Use of the Fungus as an Insecticide.

The question is often asked by growers and others, can natural enemies be used to keep down insect pests? Experiments have been carried out to supply an answer to the question. The results of these experiments generally have been to show that only a limited amount of relief can be expected from this source. There is no doubt that the method of pitting nature against itself is a most

*A micron is approximately $\frac{1}{25000}$ of an inch.

economical one, and that most satisfactory results might be expected from it, but it would appear that we have not yet learned how to apply these natural remedies to the best advantage. For example, Cockerell found that the Mexican fungus worked great destruction among the grubs in the damp atmosphere of a bottle, which contained some wormy apples; but out in the orchard its effects were inconsiderable, and he adds the remark—"There is no hope that it will ever prove efficacious in our dry climate." Although the fungus dealt with was supposed to be *Sporotrichum globuliferum*, yet it is sufficiently allied to ours, to render the results generally applicable. However, there are also experiments to fall back upon, in which this identical fungus was used, though on other insects. R. H. Pettit* connected with the Cornell University Agricultural Station, experimented with the Mealy Isaria on a number of different grubs, and the results were very unsatisfactory.

White grubs, the larvae of *Lachnosterna*, were dusted with conidia, and after four months, no trace of the fungus was visible. Although most of the specimens died, they showed no trace of the fungus. Again, 15 specimens of the larvae of *Pieris rapae* were dusted with conidia, and in about 20 days the adult insects emerged. However, a certain measure of success attended a third experiment. Seven specimens of the common brown and black caterpillar *Pyrrharctia isabella* were infected by fastening the conidia with white of egg, by means of a brush. After 20 days, all but two were attacked by the fungus, and "of the five attacked, four were dead, curled up and covered more or less densely with a thick cottony mass of mycelium, most prominent on the ventral side."

The Chinch-bug fungus and the Locust-fungus are now both pretty well known, and the success of their application seems to be so dependent on the weather conditions, that the results naturally vary. In the Year Book of the United States Department of Agriculture for 1901, Dr. Howard, Government Entomologist, has an article on "Experimental work with Fungus Diseases of Grasshoppers," and he comes to the conclusion that "The results are definite enough to induce still further investigation, which will be carried on during the summer of 1902, but the results obtained so far, do not justify very sanguine hopes." He notices that the work done in Victoria, by Mr. French, the Government Entomologist, seems to have been very successful with the Mucor Locust-fungus. In the Year Book for 1902, just come to hand, experiments on an extensive scale to give the South African grasshopper fungus a thorough and practical test are recorded. There have been some successes, but the general summing up is not favourable. "It now seems probable that very great reliance can not be placed on this fungus disease. Either it does not work with our grasshoppers as readily as it does with the South African locust, or our climate makes our species of grasshopper more resistant or the fungus less operative."

*Studies in Artificial Cultures of Entomogenous Fungi. Bull. 97, Cornell Univ. Ag. Exp. Sta., July, 1895.

Conclusion.

The parasitic fungus on the codlin moth larva is easily propagated, and the spores are readily produced. The spores may be sprayed in water, at the same time as other spraying mixtures are applied alongside, and the results of both noted and compared. If by this means an epidemic could be spread among the grubs so as to effectually reduce their numbers, it would be a simple way of dealing with the pest. It would seem however, that it is only in certain seasons and in certain localities that the fungus is produced in sufficient abundance to produce noteworthy results, and it could only be used at present as an addition to, and not as a substitute for, other means which have proved themselves to be more or less effectual.

ANIMAL PARASITES.

By A. A. Brown, M.B., B.S.

No. 9.

INTESTINAL ROUND WORMS.

The intestinal tract of animals, man included, harbors many varieties of worms. There they sojourn an indefinite period of time. In some instances they long take up their abode, and in other cases they briefly tarry. Removed from the tissues of the intestines they soon perish, as they are quite unable to support themselves independently of the tissues of their hosts. In different regions of the tract different varieties of the worms are found, some live only in the stomach, some in the small, and others in the large intestine. As regards size, they vary considerably. Some are only a few lines long, others may measure several inches in length. The age of their hosts plays some important part with respect to susceptibility to infestation. Young animals are more prone to be infested than older ones, whose tissues are fortified against invasion. As age advances, the power of the parasite to thrive diminishes, and in older animals, as a rule, few round intestinal worms are ever found. When present, they may, in some animals, cause marked symptoms, and in others they may produce no ill result. The embryos escape in enormous numbers from the alimentary tracts of the animals that harbor the adult parasites, and in damp situations, or enclosed in the bodies of snails, molluscs, caterpillars, worms, &c., they undergo further development. Then, after a certain time, they are found as free swimming agents, and are carried by the waters over the lands, where they fix themselves on to blades of grass or leaves of other plants used as food by man and lower animals. It is from drinking water obtained from river, or well, or reservoir supply, or from the consumption of food plants, that the embryos are introduced into the stomachs of human beings, as well as those of lower animals.

Lung worms, from the functions which the invaded organs discharge, always cause more or less discomfort, if they do not actually seriously impair health. Intestinal worms may, in some instances, exist, and give no indications of their presence, and, in other cases, may cause the death of their hosts either from impairing nutrition, or from reflex nervous irritation, or from peritonitis, due to their having perforated the bowel. When present in large numbers, wasting may be a marked sign from nutrition being perverted. The food ingested by animals undergoes elaboration through the chemical action upon it of the digestive juices of the stomach and intestines. When digestion has proceeded far enough, the soluble products of the process are absorbed by the lacteals and blood vessels. A certain amount of food is daily required by all animals to build up their tissues, and repair tissue-waste, maintain animal heat and force, and preserve health. In the animal economy, the food that is consumed not only builds up

tissues and supports vital processes generally, but is the source of animal heat, just as the coal burnt in the furnace is the source of physical heat. Vital processes are properly sustained by the tissues being sufficiently nourished with suitable food. Intestinal worms, by feeding upon the blood and nutrient juices in the intestines of their host, impoverish it, and deprive it of that nutritious material which is required to repair tissue-waste that is continuously going on in its body. When the metabolism of the food is perverted, the animal is practically subjected to starvation. It becomes thin from the fixed tissue elements being consumed to keep up the vital processes, and the greater the demand on these tissues the greater the loss of weight and strength.

The worms fix themselves to the walls of the intestines by special organs of attachment, and imbibe the lymph and blood of their host. In the lower animals, in some cases, their presence is never even suspected, because they so little disturb the health of their host, but in human subjects they always more or less provoke definite symptoms, and in some rare instances seriously threaten the lives of their victims.

Intestinal worms are common in all animals, in all parts of the globe. They play some important part in the economy of their hosts, and it is, perhaps, a general provision of nature that they should not endanger their lives, although at times this provision is departed from.

Historically, their existence dates from the days of Moses, but the ancients were ignorant of the places of their development. They were thought capable of arising spontaneously. There is no such thing as spontaneous development. All creatures develop from an ovum (egg), originating in the body of a parent. The life history of round worms is so complex, and their manner of reaching, in minute form, the bowels of their hosts, by means of ingested food and water, so various, that it is no wonder, since they could not be traced until mature stages, spontaneous origin was ascribed to them. As regards treatment, intestinal worms differ from lung worms. Lung worms are not easily expelled. Intestinal worms, by judicious procedure, can be compelled to forsake their hosts, by the use of suitable drugs. A purgative should first be given to clear out the contents of the intestinal tract, and all food should be withheld for some nine or ten hours, and the vermifuge administered. When given with due precautions the specific drug has a chance of making its action felt on the parasite.

GENERAL NOTES.

Dishorning Young Calves.

The dishorning of very young calves is comparatively painless, and can be done quickly and with ease. The method recommended by the experts of the Department of Agriculture for Ireland is to clip the hair from the top of the horn when the calf is from two to five days old, then slightly moisten the end of a stick of caustic potash, which can be obtained from any chemist, and with it rub the tip of each horn firmly for about a quarter of a minute, or until the potash has made a slight impression on the centre of the horn. The horns should be treated in a similar manner from two to four times, according to the size of the horn and the age of the animal. About five minutes should elapse between each application. If, during the interval of five minutes after one or more applications a little blood appears in the centre of the horn it will then only be necessary to give another very slight rubbing with the potash.

The following points should be carefully noted :—Roll a piece of strong paper round one end of the potash stick to prevent the fingers being injured. Do not moisten the stick too much, or the caustic will spread to the skin around the horn, and destroy the flesh. For the same reason, keep the calf from getting wet for some days after the operation.

Be very careful to rub on the centre of the horn, and not round the sides of it.

The operation should not be attempted if the calf is more than nine days old.

One man should hold the calf while an assistant uses the caustic.

When caustic potash is exposed to the air it rapidly deteriorates, and becomes worthless. When not in use it must, therefore, be kept in an air-tight bottle.

Rooting Cuttings of Vitis berlandieri.

In the *Revue de Viticulture* for 1902, E. Jachet relates some interesting features in connection with experiments made by him to find out a ready method of rooting cuttings of this American vine which has proved so valuable for reconstituting vineyards on chalky or limy soils. He found that the ringing of the yearly shoots just below a bud caused the formation of a callus, and the enlargement of the bud. These shoots were cut in the winter, just below the bud, and planted out in the nursery. While as a rule only 5 per cent. of *berlandieri* cuttings are successful by the methods in general use, this system gives about 80 per cent. of strong rootlings.

Surprise Butter Competitions.

At the request of the Irish Dairy Association the Department of Agriculture for Ireland has arranged to hold annually a number of surprise butter competitions. The following account of the procedure to be adopted is from the *Journal* of that Department, and the details may prove of interest to local dairymen. On not more than eight and not less than five occasions the Department will forward to each person who enters the competition a telegram, requesting the recipient to send to an address in Dublin a box of butter, containing 56 or 112 lbs. made on that day. The butter will be judged on one or more occasions by one or more competent and independent persons appointed by the Department.

On the basis of the highest total number of points, and provided that judges consider the exhibits show sufficient merit, the following prizes will be given in each competition:—

Prizes for First-class Butter	£2 each.
Prizes for Second-class Butter	£1 each.

Until further notice the following scale of points will be adopted in judging :—

Flavour	50	points.
Texture	30	,,
Colour	5	,,
Packing and Finish ..	15	,,
Total ..	100	,,

The following special prizes are offered to exhibitors, provided that all the conditions of the competition are strictly adhered to, and that the total number of points obtained is not less than 90 per cent of the maximum number obtainable during the season:—

To the Exhibitor obtaining the Highest Number of Points	£10
To the Exhibitor obtaining the Second Highest Number of Points ..	£6
To the Exhibitor obtaining the Third Highest Number of Points ..	£4

Sour Clover for Green Manure.

The Sour Clover (*Melilotus indica*) which was tested at Dookie and at Ardmona last year as a green manure crop, made very satisfactory growth at both places. Self-sown plants, Mr. Pye reports, grew to a height of four feet this season at Dookie, and Mr. Melhuish, at Ardmona, sowed some seed late in May last, and by the end of September a very heavy growth had been made. The sowing in the latter case was unavoidably late, but next season it will be put in earlier, and there is reason to expect that the ideal winter-growing green manure crop for northern orchards will be found in this plant. At the Agricultural Experiment Station, Tucson, Arizona, U.S.A., this was the only leguminous plant out of many tested which was able to make sufficient growth during the winter, to be of any value for turning down by the time the apricots come into bloom. In the north growers want to be through with their first ploughing by that time, or very shortly after, otherwise in ordinary years the ground gets too

hard to make a good job. The great want in nearly all our northern district orchards is a plentiful supply of humus or decaying vegetable matter, a want which can only be supplied economically by the growth of winter cover crops. Cape barley has so far given the best results in practice, so far as weight of green stuff to turn down is concerned, but leguminous crops have the advantage that they enrich the soil by means of the nitrogen they obtain from the air. Unfortunately peas are not adapted to the average soil and climate of the northern districts, hence the importance of securing some winter growing leguminous plant suited to existing conditions. Further experiments with the sour clover will be watched with considerable interest.

Copper-soda for Peach Leaf-curl.

The difficulty of procuring really good, fresh lime in some of our fruit-growing districts has led, as was expected, to the use of the copper-soda mixture for the control of fungus diseases. Mr. H. A. Melhuish, of Ardmona, last season, used this preparation exclusively in his orchard for peach leaf-curl with the most satisfactory results. The formula employed was 6 lbs. bluestone, 9 lbs. washing-soda, and 50 gallons water. One application only was given just prior to the opening of the blossoms. On the sprayed peaches and nectarines hardly any curl-leaf showed, but odd trees left without spraying, were seriously affected. Two nectarines of the same variety were chosen for a special comparative test, one sprayed and one not sprayed, and while on the sprayed tree hardly a single leaf showed the disease, on the one not sprayed almost every leaf was badly curled. Mr. Melhuish is quite enthusiastic over the results, and intends always using this mixture in place of the Bordeaux. Though in wet districts, and especially in apple-growing centres where black spot is prevalent, the Bordeaux is more efficient than the copper-soda, yet in our drier inland parts the advantages of the latter in ease of manufacture and cleanliness in using, more than make up for any slight possible difference in efficiency. In fact it has yet to be proved whether in dry districts the Bordeaux has any advantage at all over copper-soda. It is worth noting that no injury of any kind was observed on the leaves of the sprayed trees, and that the setting of the fruit was exceptionally good.

Checking Bush Fires.

Mr. Young, forester at Barmah, vouches for the following as a practical method of checking fires, in a memorandum to the Director of Agriculture:—"I tied a number of old sacks to the axle of a water-cart, and let the tap play on same. The weight of the wet bags laid the grass flat. We lit a fire to meet the bush fire, and although it was an exceptionally hot day, and the grass as dry as tinder, in no case did the fire cross the track of wet bags. Where no water cart is handy, a dray with a few casks can be treated in the same manner, or a winnowing-sheet (usually made of bags) can be made wet and dragged by a horse with good results."

Shot-hole in the Cherry.

In the work of the Vegetable Pathologist on the *Fungus Diseases of Stone-fruit Trees in Australia,* issued by the Department of Agriculture, "Shot-hole" was shown to be due to a variety of fungi, and was met with on all stone-fruit trees grown here. The fungus most commonly causing it however, *Clasterosporium carpophilum,* was not found on the cherry, and this was the more remarkable since this particular fungus is especially common on that tree in Europe. But while on a visit to the Kiewa Valley, Mr. G. H. Robinson, assistant vegetable pathologist, noticed this species on several varieties of the cherry. It was especially prevalent, and injurious on one of the White Hearts, the exact name being unknown to the grower, while some black sorts alongside were nearly free from the disease. In addition to the shot-hole effect on the leaves, this fungus may grow upon the fruit or upon the twigs, producing a more or less rounded sunken spot or scab. Fruit severely attacked soon dries up, and at length hardly anything but the stone is left, attached to the stalk. More recently still, cherry leaves were received from Newbury, showing the usual spots and holes, and the fungus was detected in many cases, a profuse growth taking place when the leaves were kept moist for a couple of days.

The most satisfactory method of treatment will be found in spraying with Bordeaux mixture—6·4·50, just before the opening of the blossoms, and again when the fruit has set. Little good results from spraying when the trees are in full leaf. It may be noted that the spores of this fungus have been found germinating in the leaf-buds of the apricot before they were properly expanded and only half-an-inch long, so the first spraying must take place before this. All diseased twigs should of course be removed when pruning.

Grinding Feed.

While there is considerable difference of opinion as to the advisability of grinding grain for some farm animals, it is generally conceded that it pays to grind for the dairy herd. A cow giving a large flow of milk needs all her energy to secrete the milk and to digest the large amount of feed which must be used for that purpose. It is for this reason important to make the process of digestion as easy and rapid as possible. A good grinder with suitable power to run it should be part of the equipment of every well conducted dairy farm.—[C. H. Eckles, Missouri Experiment Station.]

EXPORTED PRODUCTS' ACT.

Regulations.

The following Regulations have been approved by Order in Council under the Exported Products' Act 1898:—

Every person intending to export any butter shall, unless otherwise permitted by an Inspector, cause such butter to be placed in a cool store, and there retained until the temperature of the same has been reduced to a temperature not exceeding 32 degrees Fahrenheit

Every person intending to export butter or cheese from the State of Victoria shall, at least before Noon of the day preceding that on which such butter or cheese is to be removed from any cool store for export, give, or cause to be given, notice, in writing, to the officer in charge of the Government Cool Stores, Melbourne, of such his intention, and such notice shall contain full particulars as to the number of cases, kegs, boxes, or packages, as the case may be, in which such butter or cheese is contained, together with the stamps or marks and weights of each case, keg, box, or package.

Scale of Charges at the Government Cool Stores.

Produce	Treatment, etc.		Storage.	
Butter or Milk ..	Per box per two weeks or any portion thereof, including handling, freezing, and shipment ..	3d.	Per package per week following or portion of week ..	1½d.
Butter ..	Per cask per two weeks or any portion thereof, including handling, freezing, and shipment ..	6d.	Do.	3d.
Cheese ..	Per case 1 cwt. per two weeks or any portion thereof, including handling, freezing, and shipment ..	6d.	Do.	3d.
,,	Per 100 lbs. for ripening, first week	3d.	Do.	1½d.
Eggs ..	Per case holding 25 dozen per first week or any portion of same	3d.	Do.	1½d.
,,	Per case holding 36 dozen per first week or any portion of same	5d.	Do.	2¼d.
,,	Per dozen for export, including, grading, packing, case, and 14 days' storage	1½d.	Do.	1½d.
Poultry — Chickens, Fowls, Ducks	Per pair for export, including grading, killing, dressing, packing, case, and 21 days' storage ..	7d.	Do.	1½d.
Geese, Turkeys	Per pair for export, including grading, killing, dressing, packing, case, and 21 days' storage ..	1s.	Do.	1½d.
Game ..	Per pair (12 pairs to 24 pairs to case)	2d.	Do.	1½d.
,,	Per pair (25 pairs to 50 pairs to case)	1d.	Do.	1½d.
,,	Per pair (over 50 pairs to case)	½d.	Do.	1½d.

Produce.	Treatment, etc.		Storage.	
Rabbits—				
Furred ..	Per pair for export, including grading, packing, case, handling, branding, shipping, and 21 days' storage	2d.	Do.	1½d.
Skinned ..	Per pair for export, including grading, packing, case, handling, branding, shipping, and 21 days' storage	1½d.	Do.	1½d.
Hares ..	Per pair for export, including grading, packing, case, handling, branding, shipping, and 21 days' storage	4d.	Do.	2d.
Mutton ..	Per carcase, including handling, freezing, loading, calico wrap, bagging, and 14 days' storage ..	10d.	Do.	1½d.
Lambs ..	Per carcase, including handling, freezing, loading, calico wrap, bagging, and 14 days' storage ..	9d.	Do.	1½d.
Pork ..	Per carcase, including handling, freezing, loading, calico wrap, bagging, and 14 days' storage ..	9d.	Do.	1½d
,,	Per side, including handling, freezing, loading, calico wrap, bagging, and 14 days' storage	6d.	Do.	1½d.
Veal ..	Per carcase, including handling, freezing, loading, calico wrap, bagging, and 14 days' storage ..	1s.	Do.	3d.
,,	Per side, including handling, freezing, loading, calico wrap, bagging, and 14 days' storage	9d.	Do.	1½d.
Beef ..	Per body, including handling, freezing, loading, calico wrap, and 14 days' storage	10s.	Do.	2s.
,,	Per quarter, including handling, freezing, loading, calico wrap, and 14 days' storage	2/6	Do.	6d.
,,	Per piece, including handling, freezing, loading, calico wrap, and 14 days' storage	1/3	Do.	3d.
Meat ..	Sundries per 50 lbs., including handling, freezing, and shipping, and 14 days' storage (cases & bags extra)	1s.	Do.	2d.
Fruit ..	Per case for export, including two weeks' storage ..	2d.	Do.	1½d.
,,	Per case for storage for first week	3d.	Do.	1½d.

Note.—Extra labour incurred by Double Bagging of Mutton, Lamb, Pork, Veal, and Pieces of Beef will be charged for at the rate of ¼d. per carcase or piece. Quarters of Beef ½d. each or Bodies of Beef 2d. each. Hessian Wraps will be charged for extra at schedule prices.

Weighing of Mutton, Lamb, Pork, Veal, Beef, &c., up to 10 per cent. is included in the above charges. Additional weighing will be charged for at the rate of ¼d. per carcase of Mutton, Lamb, Veal, Pork, or Piece of Beef; ½d. for Quarters and 2d. for Bodies of Beef.

Butter, &c., arriving at the Cool Stores and taken delivery of the same day before being put in Freezing Rooms will be charged 1d. per case

All charges must be paid by the Shipper or his Agent together with freight, &c., before obtaining delivery of Bills of Lading.

E. G. DUFFUS,
Secretary for Agriculture.

RAINFALL IN VICTORIA.

MONTHS OF OCTOBER AND NOVEMBER, 1903.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in Oct., 1903.	Average rainfall for each Area for the month of Oct. based on all previous years of record	Maximum fall recorded within each Area during Oct., 1903.	Actual Average rainfall recorded in each Area in Nov., 1903.	Average rainfall for each Area for the month of Nov., based on all previous years of record.	Maximum fall recorded within each Area during Nov., 1903.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	1·43	1·75	1·88 at Beulah	2·19	0·98	3·67 at Rainbow
B	1·47	2·26	2·89 ,, Apsley	2·08	1.37	2·97 ,, Nhill
C	2·34	3·11	4·16 ,, Ararat	2·21	1·71	3·70 ,, Stawell
D	2·48	3·58	3·19 ,, Cape Patton	2·39	1·96	3·34 ,, Colac
E	1·83	1·84	2·79 ,, Echuca	2·27	1·46	2·78 ,, Kerang
F	2·16	2·55	3·10 ,, Dookie	1·53	1·81	1·91 ,, Tungamah
F^1	3·11	2·80	3·94 ,, Yea	2·65	2·12	3·78 ,, Yea
F_2	3·44	3·55	4·33 ,, Tallangatta	2·01	2·65	3·01 ,, Yackandandah
G	3·27	2·59	3·66 ,, Fryerstown	4·45	1·87	5·22 ,, Maldon
H	3·15	3·24	4·23 ,, Daylesford	3·91	2·57	5·08 ,, Daylesford
I	2·55	2·90	5·19 ,, Ballan	4·15	2·21	4·93 ,, Sunbury
I^1	2·87	3·44	3·44 ,, Dandenong	3·05	2·78	3·75 ,, Cape Schanck
K	3·95	4·56	5·22 ,, Warburton	2·76	3·42	4·26 ,, Warburton
L	2·58	3·08	3·16 ,, Traralgon	2·42	2·66	3·61 ,, Bairnsdale
M	—	3·58	1·25 ,, Gabo	—	3·04	3·48 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville. and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

ARRIVALS IN MELBOURNE OF BUTTER and Butter ex Cream in Tons net, by Rail and Steamer from the different districts of the State, for the first eleven months of the years 1903 and 1902 respectively.

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
January ..	1985	1879	362	358	66	127	870½	817	686½	577
February ..	1383½	1301½	90½	206	51½	50	814	630	427½	415½
March	1371	977½	112	92	27	25	740½	650	491½	210½
April	910½	597½	140	60	14½	16	443	359	313	162½
May*	444	670	92	95	9	13	204	421	139	141
June	595½	473	118	40	13½	22	213	247	251	164
July	561½	435½	106	54½	16½	17	179	190	260	174
August	641	468	163	99	33	24	122	122	323	223
September ..	1288	1942	323½	216	87½	63	317	267	560	496
October	2122	1807	439	360	174	92	697	567	812	788
November ..	2750	2049	622	430	201	94	943	787	984	738
Total ..	14,052	11,700	2568	2010½	693½	543	5543	5057	5247½	4089½

* During May, 1903, about 350 tons of butter were sent to Melbourne by road whilst the railway strike was on.

NOTE.—Previous statements have been found incomplete, owing to the Railway Department not including deliveries by rail to Government Cool Stores in the data from which this table was compiled, but this omission has now been rectified.

PERISHABLE AND FROZEN PRODUCTS delivered from the Government Cool Stores for the months of October and November, 1903 and 1902 respectively.

Description of Produce.		October.		November.	
		1903	1902	1903	1902
Butter..	lbs.	1,796,200	505,232	4,725,440	702,128
Milk and Cream (concd.) ..	cases	530	956	821	900
Poultry	head	257	6,576	682	11,261
Game	,,	—	—	132	—
Rabbits and Hares ..	pairs	41,248	17,313	39,944	28,067
Mutton and Lamb ..	carcases	5,696	1,387	8,880	33,688
Veal	,,	201	—	—	294
Pork	,,	11	—	27	—
Beef	qrtrs.	69	24	34	28
Fruit	cases	70	—	—	—
Sundries	lbs.	7,450	5,036	5,867	5,426

VICTORIAN PERISHABLE & FROZEN PRODUCTS exported from the State for the months of October and November, 1903 and 1902 respectively.

Description of Produce.		October. 1903	October. 1902	November. 1903	November. 1902
Butter..	lbs.	2,424,340	2,079,363	6,100,400	2,914,361
Milk and Cream	cases	508	618	809	693
Cheese	lbs	86,432	142,942	101,040	171,781
Ham and Bacon	,,	69,440	42,320	81,600	42,440
Eggs	dozen	4,200	—	2,400	—
Poultry	head	3,750	6,805	7,185	15,405
Rabbits and Hares ..	pairs	55,404	19,840	49,920	54,644
Mutton and Lamb ..	carcases	9 855	3,432	44,561	45,704
Veal	,,	310	616	649	1,461
Pork	,,	556	—	74	—
Beef	qrtrs.	472	99	365	1,046
Fruit	cases	2,156	375	2,838	400
Fruit Pulp	,,	5,430	—	4,209	2,703

R. CROWE.

Fruit and Plants.

EXPORTS to Australian States and New Zealand only, Inspected during October and November, 1903.

Fruit.	Cases or Packages Inspected. October.	Cases or Packages Inspected. November.	Certificates Given. October.	Certificates Given. November.
Apples	169	43	38	17
Apricots..	—	13	—	13
Bananas..	1555	1259	221	258
Cherries..	40	3288	15	209
Cucumbers	86	119	48	71
Gooseberries	2	611	1	41
Lemons	1373	1072	137	144
Loquats	24	27	18	15
Oranges	1400	771	193	164
Passion Fruit	32	9	28	6
Pineapples	262	264	103	136
Plums	—	48	—	12
Tomatoes	67	79	35	40
Total Cases Fruit ..	5010	7603	847	1126
Plants .. .. pkgs.	9	11	3	9
Totals	5019	7614	850	1135

J. G. TURNER,
For C. French.

PUBLICATIONS ISSUED BY THE DEPARTMENT.

Bulletins.

Reprinted from the Journal.

No. 1. Impressions of Victoria from an Agricultural Point of View. By S. Williamson Wallace.
No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
No. 3. *Black Spot of the Apple; together with Spraying for Fungus Diseases. By D. McAlpine.
No. 4. Review of the Past Butter Season. By R. Crowe.
No. 5. Two Years' Field Work of the Chemical Branch. By F. J. Howell, Ph. D.
No. 6. Co-operative Forage Experiments in Southern Victoria. By F. J. Howell, Ph. D.
No. 7. Field Experiments of the Past Year by the Chemical Branch. By F. J. Howell, Ph. D.
No. 8. The Modern Silo. By T. Cherry, M.D.
No. 9. Take-all and White-heads in Wheat. By D. McAlpine.

* Out of Print.

Guides to Growers.

No. 19. Lavender. By J. Knight.
No. 20. Broom Corn. By J. Knight.
No. 24. The Fig Industry. By C. B. Luffmann.
No. 25. Cultivation and Treatment of Tobacco. By A. J. Bondurant.
No. 26. Treatment of the Raisin Vine. By C. B. Luffmann.
No. 28. Regulations under the *Vegetation Diseases Act* 1896.
No. 31. Wheat Experiments, 1896. By Hugh Pye.
No. 32. Fungus Diseases of the Raspberry. By D. McAlpine.
No. 35. Rust in Wheat Experiments, 1894 to 1896–7. By D. McAlpine
No. 41. Cider-making. By J. Knight.
No. 46. Purifying Water for Butter-making and for Country Purposes Generally. By A. N. Pearson.
No. 47. Manures in the Victorian Market. By A. N. Pearson.
No. 49. Codlin Moth Experiments. By C. French.

Revised List of Fruit Trees, &c., Recommended for Cultivation as Suitable for Marketing, Canning, Drying, Exporting, &c.
Modern Dairying. By D. Wilson and R. Crowe.
Report on the Preservation of Fruit for Shipment. By J. M Sinclair.
Report on Meat Inspection in the United States. By J. M. Sinclair.
The Butter Industry of Victoria and the British Export Trade. By J. M. Sinclair.
Prospectus and Regulations of the Agricultural College and the School of Horticulture, with Syllabus of Instruction.
Poultry Breeding and Management for the English Markets.
Report on Successful Farming in the Mallee. By F. J. Howell, Ph. D.
List of Butter and Cheese Factories in the State of Victoria.
Manures and Manuring. By A. N. Pearson.

The New Agriculture. By the Hon. I. A. Isaacs.
Reports on the Export of Frozen Produce from Victoria, 1896–7, 1897–8, 1898–9. By D. Wilson.
The Beet Sugar Industry in Victoria. By A. N. Pearson.
List of Exporters of Agricultural Products.
The Scientific Directing of a Country's Agriculture. By A. N. Pearson.
Report by Hugh Pye, Principal, Agricultural College, Dookie, on the Experimental Work of the College for 1899-1900.
Silos and Ensilage. By J. L. Thompson.
Additions to the Fungi on the Vine in Australia. By D. McAlpine.
Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
Chart for the Guidance of Dairymen. By R. Crowe, Dairy Expert.
Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
Report of Conference on the Elevator System in the Handling and Shipment of Grain.
Annual Reports, 1899, 1900 and 1901.

Any of the above may be had Free, on application to the Secretary for Agriculture.

Destructive Insects of Victoria, Parts I., II., III. By C. French. Price 2s. 6d. each.
Fungus Diseases of Citrus Trees in Australia. By D. McAlpine. Price 2s.
Fungus Diseases of Stone Fruit Trees in Australia. By D. McAlpine. 165 pp., 10 colored plates. Price 2s. 6d.
Australian Fungi. By Dr. Cooke. Price £1 1s.

Works on Viticulture. Translated from the French by R. Dubois and W. Percy Wilkinson.

Wine-making in Hot Climates. By L. Roos. 273 pp., 61 illustrations, 5 plates. 1900. Cloth-bound, 2s.
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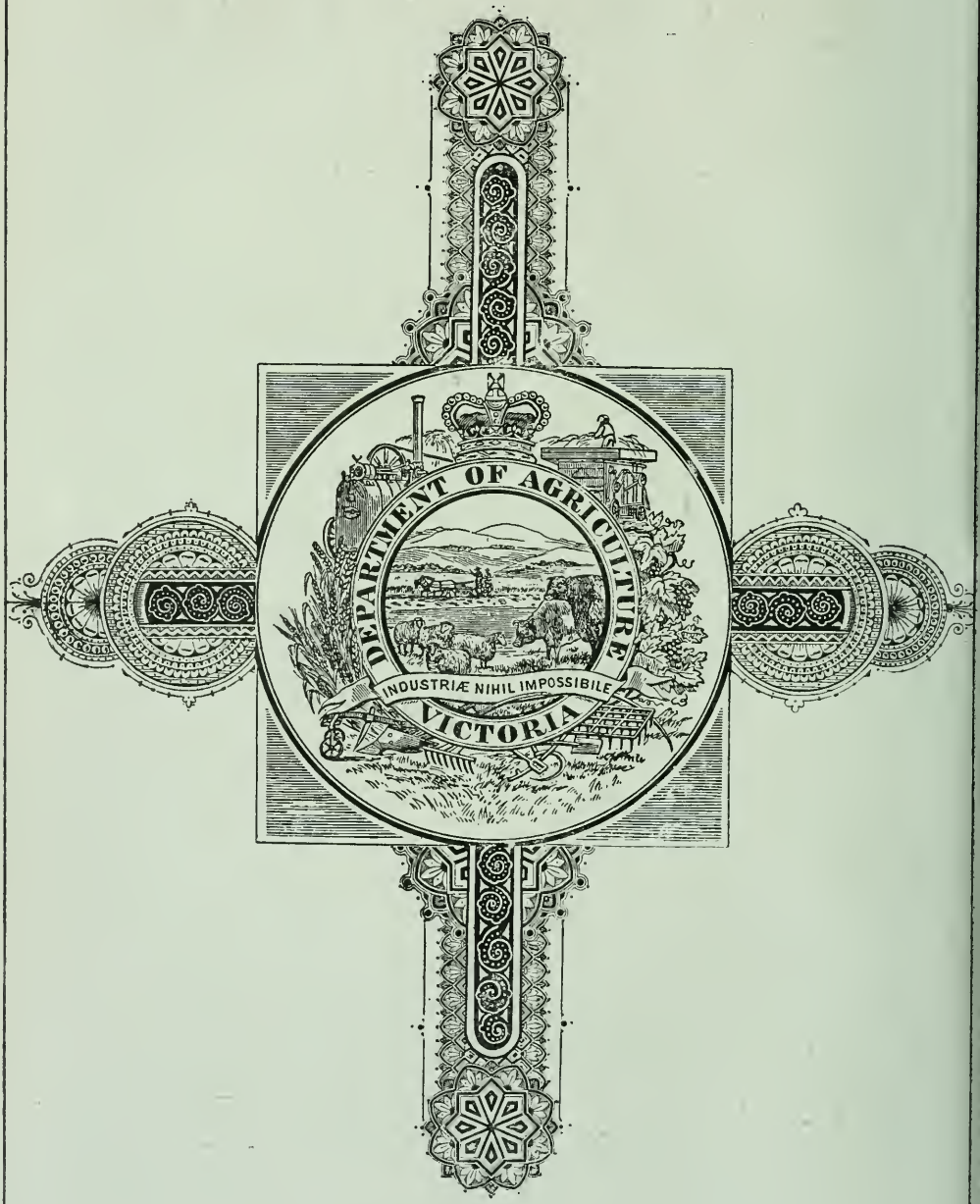
Manual of Modern Viticulture; Reconstitution with American Vines. By G. Foëx. 270 pp., 5 colored plates. Paper covers, 1s. 6d.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1904

The Journal is now issued bi-monthly, that is to say, every alternate month. The Minister of Agriculture has directed that a charge of 2s. 6d. per annum shall be made, and to persons outside the State the charge will be 3s. 6d. Those who desire to receive future issues must, therefore, remit that amount without delay to the Secretary for Agriculture.

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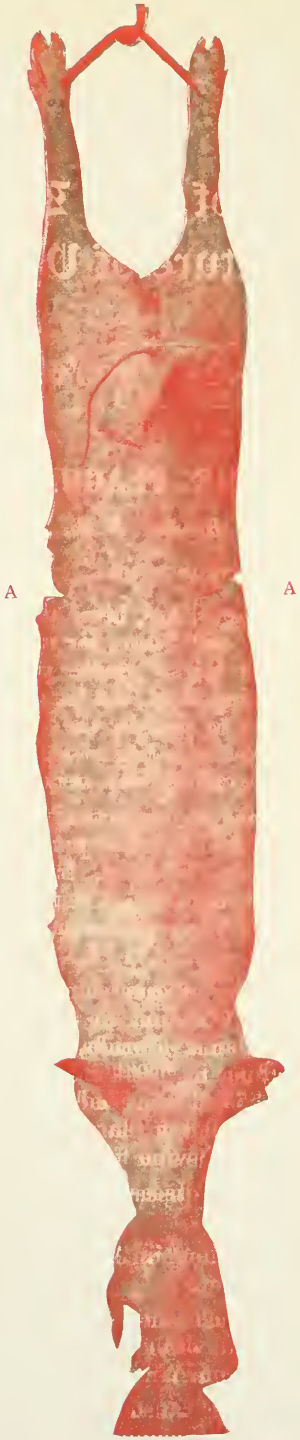

FIG. 1.—Carcase of Pig dead of Swine Plague, showing diffuse redness of skin. A A Incisions made by Inspector indicating condemnation.

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MARCH, 1904.

SWINE PLAGUE.

By A. A. Brown, M.B., B.S.

Introduction.

Swine plague, by its ravages, has been occasioning considerable concern to the producers of our State, for it has been the cause of extensive mortality amongst pigs. Some years ago it, no doubt, made its presence felt in Gippsland, but in consequence of my then not getting fresh specimens to decide the disease, I could not do more than pronounce a provisional diagnosis. I announced at that time that the disease then prevailing was very probably swine plague.

On March 20th last, I had an opportunity of seeing a case, from the lymphatic glands of which I made pure cultures of the specific germs of swine plague. On the 21st idem., from the lesions presented and from bacteriological examination, I reported the disease to be swine plague and since that time numerous cases have occurred in different parts of the State.

The first account of swine plague came from Ohio in 1833. It was next reported in South Carolina in 1837. In 1838 it was in Georgia, and in 1840 in Alabama, Florida, Illinois and Indiana. In 1843 it was in North Carolina, in 1844 in New York and in 1845 in Kentucky. From 1846 to 1855 it appeared to be on the increase in the United States. It is the belief that the disease was introduced into America by importations of swine from Europe.

In 1877 Klein studied the disease and designated it pneumo-enteritis of the pig.

In 1885–6, it was very prevalent in America and was investigated by Salmon and called hog cholera.

In 1887 it raged in France and was studied by Cornil and Chantemesse and Rietsch and Jobert. It was supposed to have been introduced into France from Africa.

In Denmark and Sweden it caused great mortality in 1887, and was investigated by Bang and Selander. It was supposed to have been introduced into those countries from England.

It is not known how it came to be introduced into Victoria, but it has been in New Zealand and parts of Australia for some years.

Definition.

Swine fever, swine plague, or pig typhoid is a specific, acute, infectious disease characterised by inflammation of the lungs, intestines, lymphatic glands, and other organs, and by an eruption on the skin of red points or patches. The redness appears about the ears, neck, back, belly, inner aspect of the thighs, vulvo-anal region legs, and feet.

Cause of the Disease.

Swine fever is a disease caused by a specific bacillus. It is infectious in the true sense of the term. It would appear that we have in swine plague a disease, the germs of which can be scattered in dust by the wind, and may be breathed in by the pigs with the atmospheric air. In isolated institutions the disease has made its appearance in a subtle fashion. It is possible for it to be introduced into any place on fodder, or in the dusty clothing or muddy boots of human beings.

It attacks pigs of all ages, and it is a virulent disease amongst young pigs. The germs may also enter the system through wounds of the skin. In the majority of cases, in my opinion, the virus gains entrance to the body through the digestive tract.

The germs then may enter the system either through the lungs, or the intestinal tract, or the skin. It does not signify by what channel the germs invade the system, they still set up the specific disorder of swine plague, no matter whether the symptoms be transient and slight or protracted and grave.

The pig is the only animal that contracts the disease spontaneously, and man is immune to it. It is a disease rather of autumn, winter, and early spring, and exposure to cold and wet, draughty, damp and insanitary styes, and improper and innutritious feeding, are factors that lower bodily health and render the system prone to invasion by the specific bacillus.

Symptoms of the Disease.

The incubation period (or that time which the germs take to develop before symptoms manifest themselves) is about from seven to ten days. There are cases in which death occurs very rapidly after the first appearance of illness. Animals may die in two or three hours after first showing signs of illness.

Swine plague may sometimes present features of a malignant character. In these cases there is an absence of the usual symptoms, but death is speedy. Death may take place in an hour or two without characteristic symptoms. In fact death may be so rapid as to lead to the suspicion that poison was at the root of the mischief. Cases that occurred at Pentridge Stockade were illustrative of this state of

FIG 2.—Carcase of Pig showing discrete spots and patches, some being red and some black.

things. The animals were apparently well when partaking of their morning meal. Within two hours 40 pigs died, and the *post mortem* examination made by me revealed the cause of the mortality to be swine plague. The specific bacillus was detected in the lymphatic glands of the animals that died so suddenly, and pure cultures were made from the glands.

In fact many cases have occurred in which animals have died unexpectedly. It may occur in a large run of cases that only a very small number will be visibly diseased some time before death. Animals may be in a bad way and be a source of infection for others without showing any signs of illness on a casual inspection.

In the pig the illness usually begins suddenly, and it may be ushered in with fits of shivering. Weakness also may come on early, and the affected pig may be seen lying buried in his bedding and scarcely resents being disturbed. He hides under his bedding to avoid the light and to get away from his companions. He evinces perhaps no inclination to move at efforts being made to get him to stand. It is noticed that he is dejected in his looks and that his tail hangs limp and his ears droop. When he moves there is staggering in the gait and weakness in the hind limbs. Vomiting may be present, and, when present, it appears early in the course of the disease. There is loss of appetite and it is difficult sometimes to get the sick animal to take food. The bowels become loose and offensive. The number of dejections per day in the great run of cases may not be increased to any extent, but in some few others they may. The dejecta may in some few cases even be bloodstained. There may be frequent urination, and this symptom should excite suspicion. The animals when suffering from swine plague are very thirsty, and may be seen drinking freely.

There may be a running from the eyes and nose. Early, it is a thin fluid, but later, it becomes muco-purulent and may stick about the orifices of the organs concerned.

The disease being characterised by a pneumo-enteritic condition, the symptoms generally are of a decidedly grave character. The fever may be high. It is not uncommon to find the temperature rising to 106 deg. (normal 103 deg.) The pneumonia is generally of the croupous type, and extensive tracts of one or both lungs may be involved in the morbid process. When both lungs are involved the symptoms are profoundly aggravated. It may occasionally happen that the pneumonia is of the catarrhal type, and the symptoms then, on the part of the lungs, may not be of so grave a character.

In pneumonia there is cough, and in severe cases there is difficulty of breathing and rattling in the throat. On auscultating the chest, when the lungs are in the consolidation stage, loud bronchial breathing is heard. At a later stage, when softening of the lungs has occurred, loud moist sounds are present, and there may then be a discharge from the nostrils and mouth. Involvement of the pleura is not uncommon, and breathing then is painful, and

the pig may be heard to utter short grunts if pain is severe. The heart's action is accelerated, and the pulse increased in frequency.

Redness of the skin appears early in the disease. In white pigs it is distinctly seen. In black pigs it is not so readily noticed about the ears and back, but if the belly be examined, a diffused redness may be observed spreading from the inside of the thighs and extending along the median line of the abdomen. At a later stage a scaly desquamation of the skin takes place.

As the disease advances in its course all the symptoms become aggravated, and the affected animal gets weaker and weaker. It may become so weak that it is quite unable to stand when urged to do so. If, however, one succeeds in getting an animal that is not quite so bad to stand, it is noticed that, in consequence of the weakness, it cannot maintain the upright position but sinks down upon, and crawls about on its knees. Towards the end, the eyes become sunken in the head, the lids swollen, and a purulent discharge may issue from them (purulent ophthalmia). Later on the animal sinks into a state of collapse and it may die in a condition of unconsciousness or in convulsions.

Pathology.

On examining the carcase of a pig dead of swine fever, tumefactions round the head may be observed, the tongue is darkish in colour, and small red patches, or even ulcers, may be present on the lips, gums, and tongue.

Skin Lesions.—Along the belly and inner aspect of the thighs, and in other situations, dark red spots or dark reddish patches terminating diffusely in the surrounding tissue are observed, and on cutting through the skin dark red blood escapes from the blood-vessels. When the carcase is scalded and scraped the redness is distinctly manifested, and even black spots or patches, or ulcers, may be observed in different situations. If the rash has faded, a branny scaling of the skin may be noticed. Sub-epidermal hæmorrhagic spots, and ecchymoses also of the sub-cutaneous fat and sub-peritoneal tissues are seen. Abscesses may form beneath the skin, and bursting, leave ulcerous patches. In the lesions of the skin, bacilli are found in enormous numbers, and by means of the desquamated particles the disease may be spread widely around.

Peritoneal Cavity.—On opening the body cavity (belly) in early stages, the peritoneum may present an opaque appearance, and a little fibrin may be seen on its surface, and a little fluid noticed in the cavity. At later stages the peritoneal surface would be more opaque and the quantity of serous fluid greatly increased. The coagulable material which has exuded from the blood-vessels glues the surfaces of the coils of intestines together, and thus adhesions may be formed. The adhesions may be extensive in character, the whole of the coils of intestines may be involved, and indeed all the organs in the peritoneal cavity may be implicated in the morbid process. The exuded fluid varies in amount and is always turbid, and contains

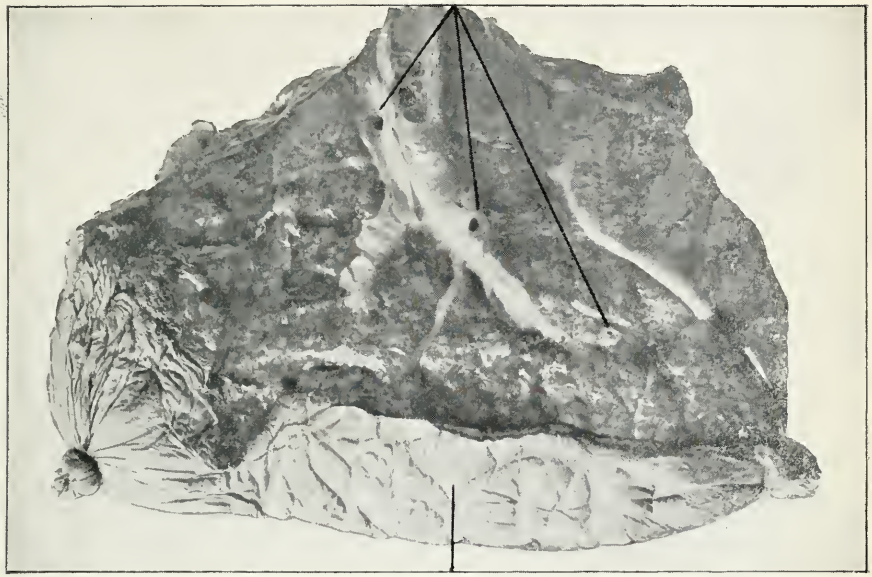

FIG 3.—Section of Normal Lung possessing a salmon color. A Surface of Pleura having a lighter shade than cut section. B Bronchial tubes greyish.

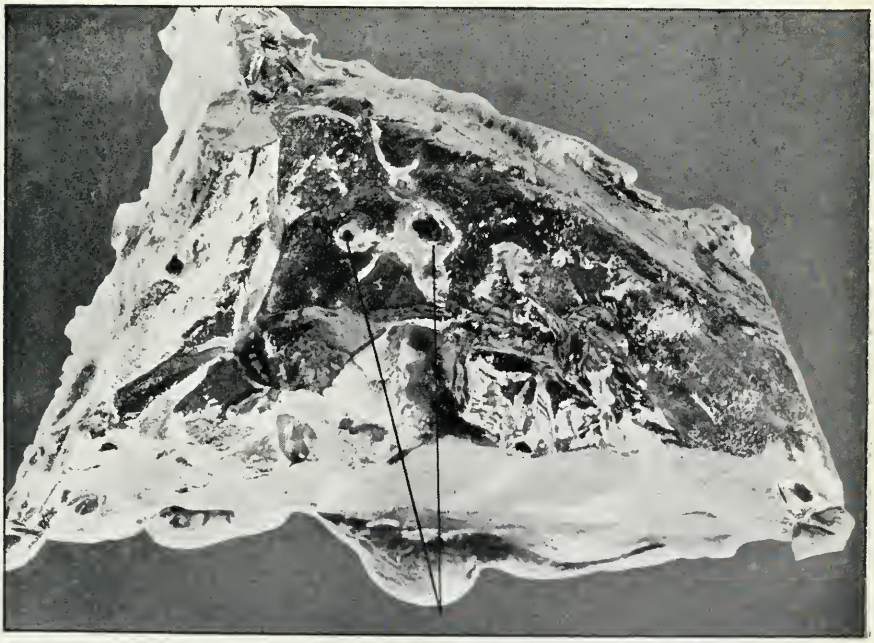

FIG 4.—First stage of Pneumonia (Engorgement), the cut surface having a dark-red color. A Bronchial tubes grey.

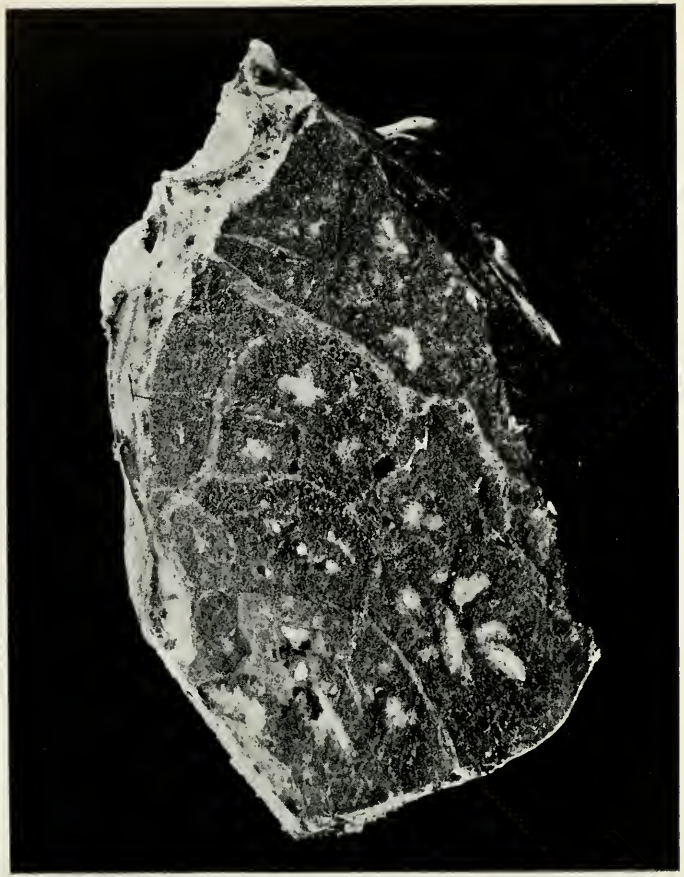

FIG. 5.—Second stage of Pneumonia (Red Hepatization or Consolidation). Cut surface has a dark reddish brown color intermixed with spots of grey.

A

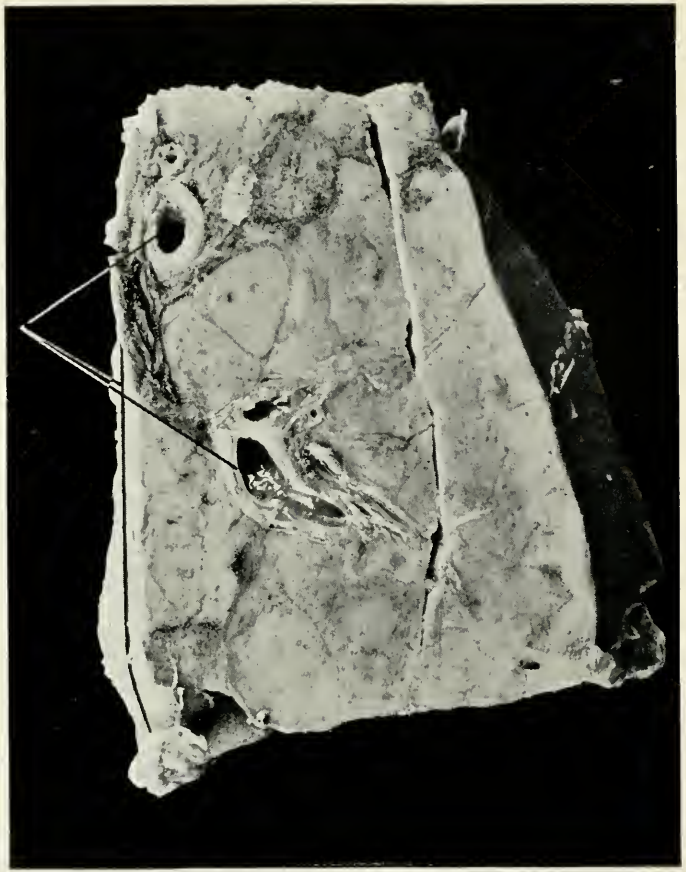

FIG. 6.—Third stage of Pneumonia (Grey Hepatization). Cut surface has a dirty-grey color. A Bronchial tubes.

flakes of coagulated fibrin. If a large amount of effusion of fluid has occurred adhesions may be prevented until its absorption has occurred. If the inflammatory process does not subside, or is of great intensity from its commencement, pus may be formed, and adhesions, along with a purulent exudation, may be encountered.

Lungs.—The pneumonia may be of the croupous or catarrhal type.

Croupous Pneumonia.—This is an inflammation of the parenchyma (cellular substance) of the lung. The poison reaches the lung from the blood, and a considerable area of the organ may be involved. The inflammation of the lung may be accompanied by inflammation of the pleura over the inflamed area, and there may be sub-pleural hæmorrhagic spots. Sometimes the inflammation extends to the pericardium and peritoneum. The morbid process in the lungs passes through three stages, and the various stages may be observed in slaughtered animals.

In the first stage (stage of engorgement) the lung becomes exceedingly vascular. It is loaded with blood and has a dark red colour. Its weight is somewhat increased, and its elasticity diminished. It is friable, and pits on pressure. From its cut surface, when pressed, there exudes a reddish frothy fluid.

In the second stage (red hepatization) the lung is decidedly heavier and its bulk is increased. The pleura over the inflamed area may be covered with lymph and the dark purple colour of the lung beneath is visible through it. In consequence of the air spaces being blocked up by the inflammatory products, the diseased lung sinks in water. It is exceedingly friable and readily breaks down. The cut surface has a granular appearance from coagulated inflammatory material which fills the air cells, projecting from them. The colour of the cut surface is dark reddish brown, and may be intermixed with grey, giving a marbled appearance to the sections.

In the third stage (grey hepatization) the weight, density, and friability of the lung are further increased. The lung is soft and pulpy, and from the cut surface a puriform fluid (pus) exudes. The colour is dirty grey or yellowish white, or gradations from reddish brown to grey may be observed. A mottled appearance may thus be presented in passing from the red to the grey stage. The bronchial tubes of the affected area are always inflamed and contain sticky, bloodstained mucus. Croupous pneumonia may terminate by resolution, or may go on to the formation of abscess. The bronchial and mediastinal glands are found inflamed and swollen.

Catarrhal Pneumonia.—The lung tissue exhibits solid, non-crepitant patches, due to inflammatory consolidation. The pleura over the affected area may not be altered in character, and the diseased portion viewed through it has a bluish colour. On section it is, in the early stages, dark red, smooth and shiny, then the colour passes through greyish red to greyish yellow, and a greyish juice can be expressed from it.

Pleura.—In croupous pneumonia, pleurisy is generally a concomitant. In early stages, the surface of the pleura is red, roughened, and covered with lymph, and later a turbid fluid mixed with flakes of coagulated lymph is effused. Adhesions may form between the pleura lining, the chest wall, and that covering the lung.

Pericardium.—Pericarditis, or inflammation of the pericardium or bag containing the heart, is sometimes seen. In the early stages, the lining membrane of the pericardium is of a red colour, it is rough and usually covered with a thin layer of lymph. Later the bag is distended with a turbid fluid having flakes of lymph floating in it, whilst its surface is thickly coated with lymph. Usually the inflammation affects not only the lining of the bag but also the covering of the heart itself. The covering on the surface of the heart forms the epicardium.

Heart.—Under the epicardium there may be hæmorrhagic spots. The cavities of the organ are full of clotted blood, and its substance may be opaque and soft.

Digestive Tract.—There may be inflammation of the mucous membrane of the digestive tract, with ulcers at various seats of it.

Stomach.—The stomach may be intensely inflamed. The lining of the organ may present a diffuse red colour, or red spots may be scattered all over it. Petechiæ. and perhaps larger extravasations may be seen over the fundus, and even ulcerations may be noticed.

Small Intestine.—The small intestine may present a reddish appearance. The internal surface may be studded with numerous dark red spots. The Peyers patches and solitary follicles of the ileum may be enlarged. Ulcers may be present and may involve the whole thickness of bowel as far as the peritoneal coat. The edges of the ulcers are raised above the surrounding membrane.

Large Intestine, Cæcum.—The serous membrane of the large intestine may have an appearance as if sprinkled with fresh blood. The mucous membrane of the large intestine and cæcum is velvety and swollen, and the ileo-cæcal valve is swollen and may be perhaps the seat of extensive ulceration. Ulcers of varying size, particularly in the situation of the lymphoid tissue, are prominent lesions. They may be $\frac{3}{8}$ of an inch in diameter, circular in form, having raised borders, and may lie near together or far apart. Perforation of the bowel of the pig is rare if, indeed, it ever occurs. The ulcers may be visible from the serous coat. A diphtheritic deposit of a dirty white or greyish yellow color may cover the mucous membrane, and on removing this the ulcers and inflammatory patches are laid bare.

Lymphatic Glands.—The lymphatic glands (mesenteric, sublumbar, inguinal, bronchial, mediastinal, gastric, hepatic) are swollen, congested, and often boggy with a whitish fluid, and on section present a reddish or greyish-red striated appearance.

Liver.—The liver is slightly swollen and hyperæmic, and its edges rounded. The surface of a cut section is opaque, and it is softer than

FIG. 7.—Portion of Stomach of Pig showing intense inflammation of mucous membrane. Shaded portions were intensely red.

FIG. 8.—Portion of small Intestine and Cæcum showing ulceration. A Ileum. B Ulcers on region of Ileocæcal Valve. C Cæcum with Ulcers studded over mucous surface.

natural. Dark red blood exudes from the cut vessels. There may be little hæmorrhages studded over its surface beneath its capsule, and occasionally necrotic patches are observed in its substance. The gall bladder may be distended and be full of viscid, dark, greenish-yellow gall.

Spleen.—The spleen is usually a little enlarged and its pulp slightly disintegrated. Occasionally stainings of a port wine colour are observed on its surface.

Kidneys.—The kidneys are hyperæmic and the capsule peels easily. Small petechiæ are sometimes seen under the capsule and throughout the cortical portion of the organs.

Brain.—The brain is congested, and in late stages softened.

In those rare cases in which the disease runs its course with great rapidity, there may be noticed little hæmorrhages, particularly of the subcutaneous, submucous, and subserous tissues and congestive conditions of the brain, gastric, and intestinal mucous membranes.

Course, Termination, Complications and Sequelæ.

In swine plague, in a large number of cases, the course is towards death. If the pneumonia be double, the tendency is for a fatal termination. In young pigs the fatality may be as high as 60 per cent. Hæmorrhage from the bowel may be a complication, and, if severe, is likely to prove fatal. Abscesses of the lungs and skin, and peritoneal adhesions are the usual sequelæ.

Diagnosis.

The hæmorrhagic lesions are fairly diagnostic of the disease. Such lesions of the lymphatic glands are fairly constant. The cortical portions, and even the entire gland, may appear hæmorrhagic on section. Hæmorrhages are pretty often seen in other situations, notably beneath the epidermis and in the subcutaneous fat, beneath the epicardium, in the cortex of the kidneys, beneath the capsule of the liver, under the visceral pleura, under the serosa of the intestines, and in the mucosa of large intestine and stomach. The ulcers of the intestines are characteristic lesions. The redness of the skin, along with the other signs, would lead one to definite expression of opinion.

Susceptible Animals.

The pig is the only animal that contracts the disease spontaneously, but guinea-pigs, rabbits, and pigeons can be experimentally inoculated. Fowls are refractory to the disease. The guinea-pig is immune to swine erysipelas.

Characters of the Bacillus.

It is a short, stout, ovoid, motile germ, 1·2 to 1·5 micro-millimetres long (about $\frac{1}{20,000}$ inch); and it grows in gelatine and agar under anærobic as well as ærobic conditions. It does not liquefy gelatine. It is destroyed at a temperature of 140 deg. Fahr.

Gelatine Cultures.—On gelatine plates the surface colonies are greyish white, discrete, flat, oval or round, with irregular borders. The surface colonies are larger than those in the depths. The deep colonies are round to oval in shape, and homogeneous.

In gelatine stab cultures the growth has a nail-like appearance. The surface growth is flat and white. In the depth the growth is greyish white and beaded. Shortly after inoculation of the tube many round colonies appear in the needle track, and these eventually unite to form a granular white line with a finely beaded border.

Agar Cultures.—On agar plates the surface colonies are greyish-white with round or irregular borders; in the depth the colonies are greyish white and round to oval.

Stab cultures are nail-like, and in the depth, the edges of the spike are beaded. The spike of the nail has many irregular, thin scale-like projections along it.

In streak cultures, on agar and gelatine, the growth spreads over the surface.

Broth.—In broth a white sediment falls to the bottom of the tube and the reaction is not altered. The culture has a peculiar porky odour.

Potatoes.—On alkaline potato the growth has a straw-yellow to light-brown colour, and it is abundant. On acid potato the growth is scanty and white.

Milk.—Milk is not coagulated and the re-action remains alkaline.

In cultures the growth, if viewed by transmitted light, has an opalescent appearance.

The germ does not form spores, yet notwithstanding this, it may maintain its existence for a long period in the soil.

Staining.—It is readily stained by aqueous and alcoholic solutions of the aniline dyes, but it does not retain the stain when treated by Gram's method. The bacillus of swine erysipelas retains the stain by Gram's method.

Organs, Secretions and Excretions in which the Virus is Contained.

The virus is contained in the bronchial mucus, urine, bowel evacuations, desquamated particles of skin, lymphatic glands, liver, kidneys, spleen, and blood.

It is eliminated from the system by the bronchial mucus, urine, bowel evacuations, and skin desquamations.

Inoculation Experiments.

On 20th March, at 8 p.m., a pigeon was inoculated with a large quantity of juice expressed from the mesenteric glands of a pig dead of the disease, and at 7 a.m. on 21st it was in a moribund condition

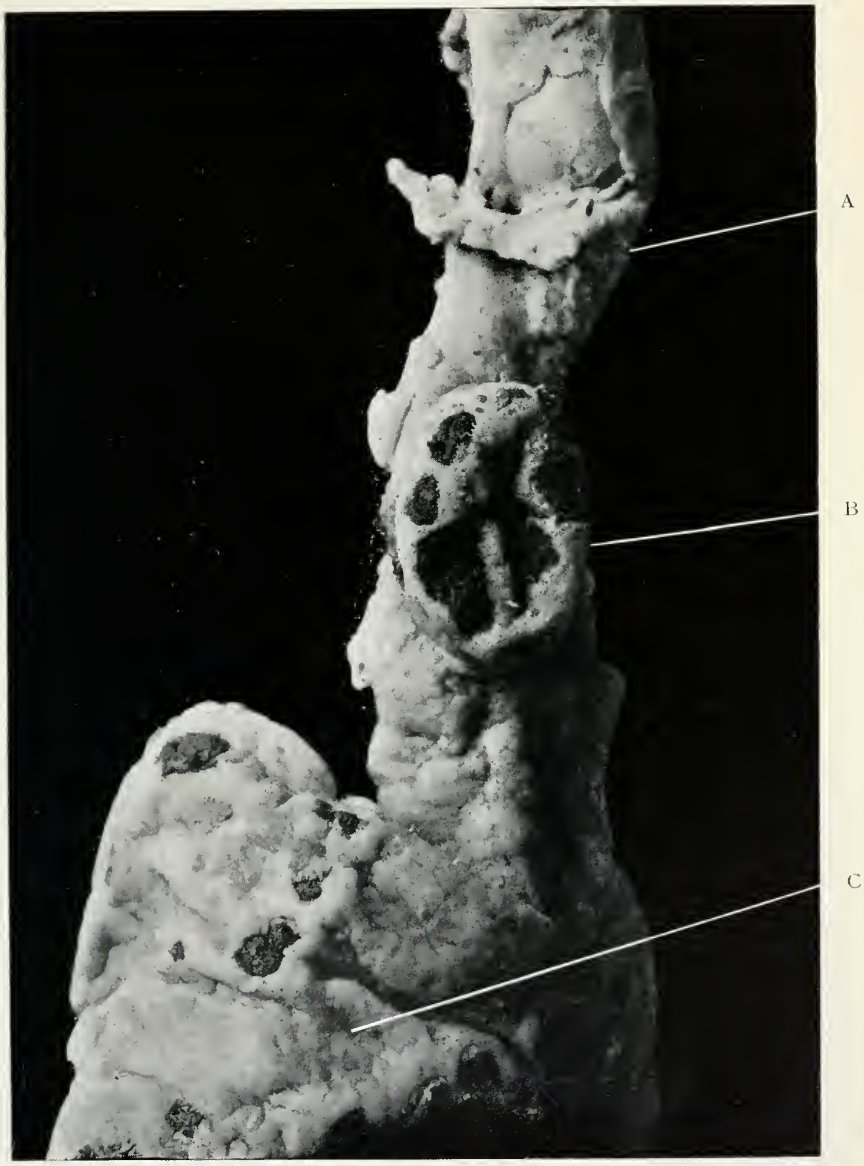

FIG 9.—Enlarged illustration of portion of Ileum and Cæcum showing Ulcers. A Ileum. B Ulcers on region of Ileocæcal valve. C Cæcum.

FIG 10 —Enlarged illustration of Cæcum showing Ulcers.

and died about an hour later. The virus was found in its blood and organs.

A guinea-pig inoculated at same time with a large quantity of the juice from the same source, died in about 14 hours after inoculation. The virus was found in its blood and organs.

A guinea-pig and pigeon were inoculated with small quantities of virus derived from the mesenteric glands of a pig dead of the disease. The guinea-pig died 5 days after inoculation, and examination revealed abscess at seat of inoculation, patchy croupous pneumonia of lungs with adhesions to chest walls, enlarged liver and spleen, and inflammation of brain and intestines. The lymphoid tissues (Peyers patches and solitary glands) of the ileum, and lymphoid tissues of the cæcum and large intestines, were the principal seats of the inflammation. The guinea-pig was very sick 24 hours after inoculation, its temperature rose to 104·5 deg. 48 hours after inoculation, and was 103 deg. on the morning of the day on which it died. The pigeon died 29 days after inoculation and was ailing the whole time. The lungs which were adherent to the chest wall, were very friable and showed old pneumonic patches. The liver was soft and enlarged, the intestines were inflamed, and here and there at the seat of the lymphoid tissues ulcers were observed. The pectoral muscles in which the inoculation was made were very friable. The virus was found in the blood and organs of both guinea-pig and pigeon.

On 31st March, a guinea-pig was inoculated with an agar culture from the spleen of a guinea-pig that died five days after inoculation with virus from a swine plague pig. Two days after, its temperature rose to 103 deg. and it was very sick. On the third day its temperature rose to 104 deg. and then it ran along or above 103 deg. till 15th April, when it sank to 102 deg. It then ran somewhere along the line of 102 deg. till the 23rd, when it rose to 102·4 deg. It sank again and then gradually rose till at noon on 29th it was 104 deg. There would seem to have been a recrudescence in this case. From 25th to 29th the temperature gradually rose and then gradually declined till 1st May, and on 2nd May it made a sudden drop to 98 deg., and from this time onward, the animal got rapidly well. The virus was observed in the blood.

A guinea-pig inoculated on 17th April with a gelatine growth of the bacillus that had passed through several generations of culture, after a few days' illness, recovered. Evidently, repeated culture had attenuated the virulence of the germ.

On 4th April a guinea-pig was inoculated with blood from the ear of an experimental pig, and after a short illness it recovered.

On April 29th two guinea-pigs were inoculated with agar cultures from tubes of repeated cultivation. Both became ill. On 8th May one was killed for examination. Intestines were found inflamed, the lungs were normal, and an abscess existed in flank at seat of inoculation. The other guinea-pig eventually recovered. On the same date

a pigeon was inoculated from the same culture, and after a short illness it recovered.

A healthy pig was inoculated at noon 30th March with a pure broth cultivation derived from the mesenteric glands of a pig dead of the disease, and on 2nd April it was very sick, and it was noticed that its breathing was difficult and that it had a cough. It would lie about and would only resent being disturbed by a short grunt. It went off its food, but was enticed to eat with warm pollard and cooked potatoes and milk. At 4.30 p.m. on 1st April its temperature was 105·8 deg., and at 10 a.m. on 2nd it was 104 deg., and at 5.30 p.m. on same evening it rose to 104·4. From 2nd to 6th it was getting worse, and its temperature ran a little above 104 deg. On the 6th the difficulty of breathing and cough had increased and loud moist rattlings in the throat could be heard. From 7th to 11th it was much about the same as on 6th.

On 12th an abscess was noticed in thigh at seat of inoculation. The breathing was still difficult and moist sounds could be heard. It could not stand long when urged to do so. It would lose the power of the fore legs, sink down upon and crawl about on its knees. Its temperature at 4.30 p.m. on 12th was 104·4 deg. At 9.30 a.m. on 13th its temperature rose to 104·8 deg., and from 13th to 16th it was much about the same as on 12th.

On 17th, at 3.30 p.m., its temperature rose to 105 deg., and it was very sick. Respirations, 28; pulse, 130; auscultation revealed moist sounds in both lungs. The ears and belly had a dirty reddish colour. On the back the skin was very scaly. The breathing seemed to be getting easier. From 18th to 22nd the temperature kept above the line of 104 deg., and it seemed to be improving. On 23rd, at 5.40 p.m., the temperature sank to 104 deg., and the reddish colour had almost disappeared. On the 24th its temperature sank to 101 deg., and from that time onward it rapidly improved in health and condition.

The virus derived from pigs that spontaneously contract swine plague is, as experimentally shown, fatal to guinea-pigs and pigeons.

A broth culture of the bacillus did not prove fatal to an experimental pig.

The virus derived from a pig experimentally inoculated, and from nutrient cultures, does not appear to be fatal to pigeons and guinea-pigs.

Preventive and Remedial Measures.

Predictions Where Neglect Prevails.

When disease breaks out in a herd, where all members of it are allowed to intermingle freely, mortality may be very great, particularly if the surroundings are insanitary. If proper precautions are not forthwith taken to combat the outbreak, 60 per cent. of the herd may die. Of the remainder of the herd a few may be observed to be

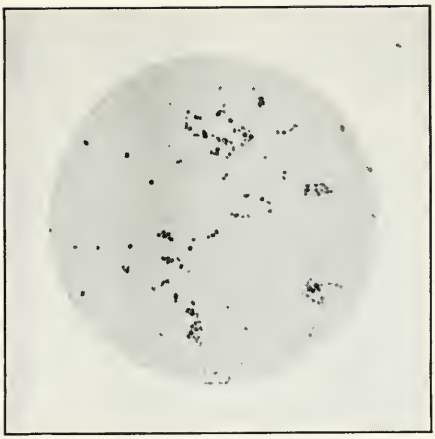

FIG. 11.—Bacillus of Swine Plague (x 1,000), stained with Carbol-fuchsin.

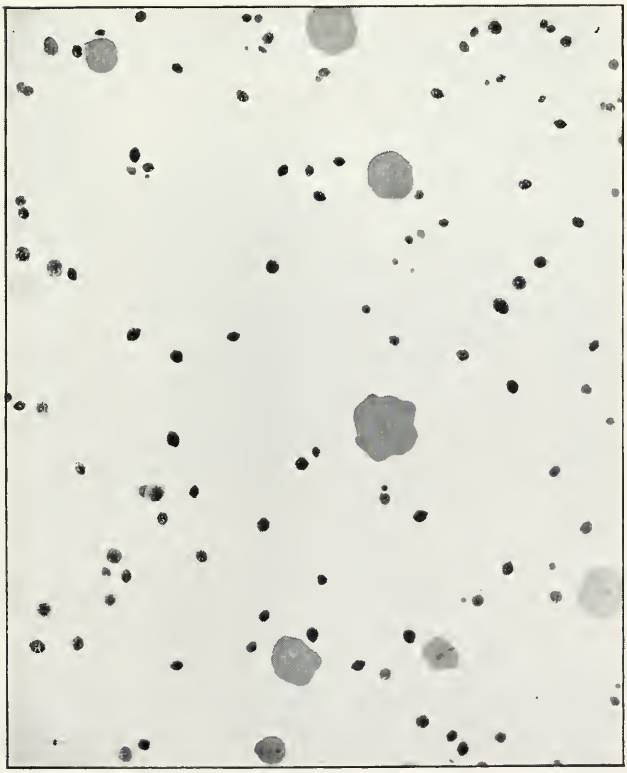

FIG. 12.—Gelatine Plate Culture. The large colonies are surface and the smaller ones deep growths. Color, greyish white.

severely ill and undergo spontaneous recovery. A few others, it may have been observed, contracted only a transient illness.

Immunity Conferred by Attack.

As a matter of fact, all susceptible animals may be attacked, and it is the experience in other parts of the world that when animals have once been attacked they are rendered immune to subsequent attacks. Again those that survived a severe attack were possessed of less susceptibility, or greater resisting power, than those that succumbed.

Steps to Pursue to Prevent Spread of Disease.

When the disease appears on a place, all pigs should be kept in secure enclosures, and should not be allowed to wander far and wide over the farm. On no account should they be permitted to trespass on roadways. They should, above all things, be prevented from fouling water courses. By strictly observing measures of this nature, the virus is prevented from being carried to other farms and infecting other herds.

Swine plague is one of the filth diseases, and insanitary conditions perpetuate it, so the most scrupulous cleanliness must be exercised to stamp it out. The styes and other enclosures must be thoroughly disinfected with approved disinfectants, and the operation must be repeatedly carried out.

In order to prevent infection reaching a farm, one must be careful to see that he does not obtain possession of a diseased animal. One must be sure of the source of any fresh pigs that are introduced.

Swine, which are affected with the plague in an occult form, may, innocently enough, be moved about from point to point spreading the disease along their course without exciting the suspicion of the inspectors and others as to the gravity of the hidden disorder. The disease may lurk in a chronic form in some animal in which it is thought the disease had become extinct, and an animal of this kind may be the focus of an outbreak. Where movement of pigs is permitted, branding must be effective and the records of brands carefully kept, so that the origin of all pigs may be traced.

When the disease makes its appearance at a place in a district previously free from it, it comes to be a question as to whether it is not prudent under such circumstances to stamp out the whole herd on the infected place forthwith. If only a few animals remain, it would be wise to kill them off, as they may suffer from the disease in a hidden form and thus continue to infect the premises. However, the slaughter of affected animals, and the quarantining and isolation of the apparently healthy in sanitary quarters, is a discreet course to follow, and perhaps should be given a trial before more drastic measures are resorted to. Under judicious restrictions, diseased animals even might be subjected to treatment, with the view of influencing the course of the disorder. The only treatment that can be expected to avail is one based on Sero-Therapy or Vaccination.

To keep swine plague within circumscribed limits, the enforcement of judicious quarantine regulations is specially indicated, and all movements of pigs, when disease breaks out in a district, should be stopped until infested places are discovered and clean places recognised. All movements should be under the guidance of the central authority, and when once pigs are moved from an inland district into the metropolitan area, they should be killed at abattoirs in that area, and not allowed transmission out of it.

Early notification of the existence of disease should be promptly sent by owners of pigs to the nearest authority, and the premises upon which it prevails should be forthwith placed in quarantine.

To keep the disease well within control no pigs should be allowed to be removed from an infected farm until it has been sanitarily improved. No movement of pigs from it, to keep within safe limits, should be allowed for fully three months after appearance of last case. It is at all times dangerous to move pigs from insanitary styes when the disease has made its appearance in them. Quarantine enforcements should not be relaxed until the styes have been placed in sanitary repair. In order to meet commercial requirements, fat pigs could, under judicious inspection, be removed from a sanitary farm to a slaughter house three months after last outbreak. It would, however, be safer to have the pigs killed and dressed on the farm and forwarded to market as bacon or fresh pork.

All pig styes should be registered and a registration fee collected by the municipal authorities, the amount of the fee to be dependent on the number of pigs kept. The fees collected could be devoted towards defraying the expenses of inspection.

Sources and Channels of Infection.

1. Pigs derived from infected farms, or pigs that have come into contact with them, or that have run over ground occupied by diseased swine are dangerous sources of infection. It has been urged that no pigs should be purchased from an infected farm. Under no circumstances should anyone run so grave a risk until it is placed in a sanitary condition, and then twelve months should be allowed to expire since last outbreak of disease before a purchase for stud purposes from such a farm is made. In outbreaks chronic cases may live three or four months without betraying distinctive signs of disease, and it is only when they die that the true nature of the case is ascertained. Evidence of cases such as these has come immediately under notice. The disease may hang about a farm long after it is thought that it has been exterminated. Farmers should raise their own pigs and not trust to purchasing animals from their neighbours. If boars are required to improve the stock they should be purchased from places above suspicion, and even then they should be kept under observation for at least one month before being allowed amongst the herd.

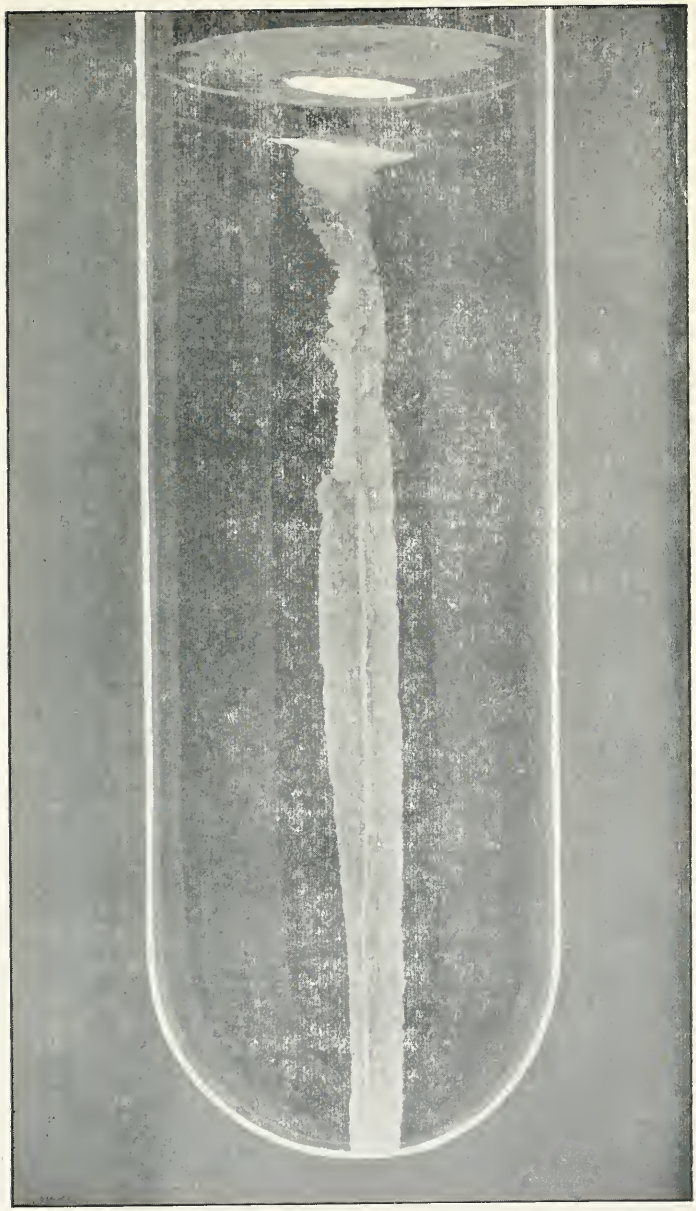

FIG. 13.—Stab Culture in Gelatine.

2. Infected streams may communicate the disease to herds below the source of infection. Running streams are fertile agents in spreading the disease. Under no circumstances should pigs be allowed access to streams, since they foul the water with their dejecta, and if suffering from disease they spread it along the course of the streams below the point of entrance of infection. The bacillus of swine plague can maintain its existence for some time in water. It can maintain its existence with bacteria usually found in water for perhaps a month.

3. The virus may be carried in feed, implements, and on the feet and clothing of persons from infected herds and premises. Desiccation and sunlight are powerful natural agents in destroying all germs, but nevertheless before such agents can complete their work spread of disease is brought about by particles adhering to feed, implements, and the boots and clothing of human beings.

4. Winds, insects, birds and various animals may transport the disease. Winds are capable of blowing about dust contaminated with the virus, and in this way the food supply may become infected. Insects and birds and various animals may carry from place to place on their feet or feathers or hair the germs of the disease, and thus lead to infection being spread through their agency. Insects may contaminate the food. The agency of insects, birds, and other animals in spreading the disease is perhaps remote, but nevertheless cases occur where it is impossible to definitely settle upon the origin of the outbreak, and therefore all possible means of spread are worthy of being noticed.

Inoculation.

Preventive inoculation methods are worthy of extended trial. The inoculation of attenuated cultures prepared in a proper fashion would seem so far to have furnished favourable results. By inoculating an animal with attenuated virus it is expected to be protected against disease. The wide prevalence and virulence of the disease, and the difficulty of controlling it by quarantine, and other methods, urges us to discover some preventive. Experiments in this direction are being carried out, but it will take a long time to determine the efficacy of the vaccine employed.

That we should hope to succeed in controlling the disease by vaccination methods is not without parallel examples. Vaccination against small-pox is the most familiar, as well as the most successful, example of this method of treatment. Diphtheria has now been robbed of its terrors by the practice. Vaccination against anthrax in sheep and cattle has now become a general practice, and vaccination against blackleg in cattle has also been marked by considerable success.

In swine plague, which also belongs to the microbic class of diseases, it is opined that a first attack when survived confers some protection against a future one, and in this direction of procuring an effective vaccine an interesting field of research is thrown open.

When opportunity offers, inoculation with bile derived from an animal sick of the disease will be given a trial.

Sanitary Styes.

A sanitary stye is, *inter alia*, one constructed with impervious floors, drains, and catchment pit, proper walls and roof, and of such construction that sunlight readily enters, and circulation of air uninterruptedly goes on. The pit should have a Californian or other cheap pump fixed in position for emptying it, and the contents should, after disinfection and after proper dilution, be sprinkled over tilled lands by a cart fitted with a sprinkler.

An impervious floor is constructed of concrete, and may, if thought advisable, be surmounted with paving bricks set in cement.

To construct a concrete floor, mix together one part of Portland cement, four parts sharp clean sand, and five parts of clean broken stone. The stone should not be over two inches in any measurement. Gravel will answer, but it is not as good as broken stone. Mix the sand and cement first, then wet and thoroughly mix them, then add the broken stone and thoroughly incorporate the lot and place it in the position for the floor. When spread out, thoroughly tamp it with a tamper and make the layer four or five inches thick. Next day topcoat the layer with Portland cement and sand, half and half. Trowel thoroughly, and when well set, which will take from 12 to 24 hours, depending on the weather, cover the surface with sand, old sacks, or anything that will keep moist for a week. Only when it is thoroughly set is it ready for use.

Disinfection of Premises and Disposal of Dead Pigs.

The sides and flooring of styes, and the ground over which diseased pigs have roamed, are infected spots, and they must necessarily be disinfected to eradicate the disease. Dead animals should be burnt or should be buried deeply in the ground in chloride of lime and then covered over with quicklime before filling in the hole. The droppings from sick animals should be disinfected with carbolic acid and lime solutions, and if it is not possible to burn them, they should be buried deeply in the ground. The floors and drains of styes when sanitarily constructed are easily disinfected.

To thoroughly disinfect styes, the floors and drains should be washed down with hot strong solutions of phenyle, and the walls after having been washed with phenyle should be limed, and the lime wash should contain a little of the chloride of lime or crude carbolic acid.

At all times the styes should be kept properly cleansed and disinfected, and the food should be cleanly prepared. The boots and clothing of attendants are, as already stated, sources of infection. It would, therefore, be wise for attendants to keep boots solely for use about the styes, and change them, in their proximity, when the work is done. Care must be taken to see that the clothing does not

get soiled, and to prevent such occurring, overalls should be worn and these also should be left in the vicinity of the styes.

Disinfectants Recommended.

Disinfectants are substances which are capable of destroying germs. They must for farm use combine cheapness with efficiency and be safe for general handling.

1. Lime.—Ordinary lime, whether slaked or unslaked, is a good disinfectant about pig-styes. In slaking lime add about half a pound to a gallon of water, and to increase its disinfecting power a little of the chloride of lime can be stirred into the mixture.

2. Phenyle.—Strong solutions should be employed, and they should be used unsparingly.

3. Carbolic Acid.—Crude carbolic acid is a cheap compound, and $2\frac{1}{2}$ ozs. to 1 gallon of water is the strength of the solution that should be employed. It can be mixed with lime washes, and when so used an effective disinfection can be relied upon.

Natural spontaneous disinfection will occur if places are exposed to the sun's rays, so all old infected buildings should be pulled down and burnt, and the sun then in the course of time will do the rest. At the end of 12 months it would be safe to assume that spontaneous disinfection has occurred.

Treatment.

A specific cure for swine plague—that is some drug which if administered would destroy the specific cause of the disease within the system or render it harmless—is as yet unknown.

Antiseptic and antipyretic drugs, and drugs that stimulate the respiratory organs, may have a certain modifying influence upon the fever and general course of the disease, but they are not capable of bringing it to a sharp termination and establishing immediate cure.

The pneumonic condition is the serious part of the disorder, and if the lesions are extensive death is inevitable. The bowel lesions in themselves are not nearly so grave, as perforation of the intestines is a rare event in the pig.

The pneumonic process runs a definite course and treatment is directed towards supporting life until the disease expends itself. There is pain (when pleura involved), cough, and oppression of breathing. To diminish the tension of the circulation, and to relieve the distressed breathing, and to increase the expulsive efforts on the part of the lungs, to get rid of bronchial secretions and other morbid products a combination such as

Carbonate of Ammonia	3 grains
Tincture of Aconite	4 drops
Solution of Acetate of Ammonia ...	30 drops

might be given in separated milk twice daily. The dose is for each 100 lbs. live weight, and lighter and heavier pigs should receive commensurate doses.

Drugs which from their antiseptic and laxative effects on the bowels may be given a trial are

Wood Charcoal	1 lb.
Sulphur	1 lb.
Sulphate of Soda	1 lb.
Boric Acid	3 ozs.
Hyposulphite of Soda	2 ozs.

The above to be thoroughly mixed together and a tablespoonful given to each pig once a day in the food.

A diet of pollard, in separated milk, the mixture having a thin consistency, will be found nourishing and laxative.

Sick pigs should be kept in well ventilated styes that are warm and dry. A plentiful supply of good straw bedding should be provided to keep the pigs warm.

NOTE.—Intestinal specimens kindly lent for photographic purposes by Mr. Batchelor, Inspector of Stock.

DAIRY INSTRUCTION AND INSPECTION.

By R. Crowe.

Shortly after the commencement of the modern co-operative butter factory system in 1888, it was discovered that if the dairying industry was to be placed on a really sound basis, a good system of dairy inspection would have to be adopted. In May, 1894, Mr. Jas. Goldie, the president of the Australian Butter and Cheese Factories Managers' Association, brought the question into prominence, and it has been a live subject ever since. At that time it was sought to have an act passed by Parliament providing for this. Upon enquiry, however, it was found that the necessary machinery was already in existence, the Municipalities having this power under the Health Act to administer a system of inspection which would, if properly carried out, do a good deal towards supplying the want. The efforts of those interested in the production of the highest quality of butter were then concentrated towards getting that machinery into operation, the Warrnambool Shire being one of the first in the State to take action, and for some time afterwards dairies had to be registered annually for a fee of two shillings and sixpence each, which fee was the means of adding to the Council's revenue upwards of £100 a year, still the dairies remained uninspected and but little benefit accrued to the industry.

The earliest real attempt to apply the supervisional sections of the Act towards the improvement of dairying was made by the Hampden Shire, which, in conjunction with the Camperdown Butter Factory, appointed a Dairy Inspector. The chief object was to improve the conditions under which milk was produced and treated. There is no doubt that much good was done, and that district has benefited greatly in consequence. This was quickly recognised by the neighbouring municipalities, and the Warrnambool and Belfast Shires and Koroit Borough inaugurated a system with equal success, despite the greater difficulties met with in the shape of existing unsuitable premises. Excepting in the cases mentioned, practically no use was made of the power in existence until the appointment of a Board by the Honorable George Graham, M.L.A., Minister of Agriculture, in March, 1900, to enquire into the alleged deterioration of Victorian butter. According to the evidence submitted to the Board by those engaged in the industry, it was soon apparent that a general system of inspection would have to be introduced if the quality of our product was to be maintained and improved and our position retained on the London and other export markets.

Bogus reports were circulated regarding the nature of the Board's intentions, and a scare created that caused many municipalities to avail themselves of the powers vested in them under the Health Act. As it was impossible to judge the earnestness of the local bodies at

the time, full credit was given for sincerity. It was therefore recommended by the Butter Board that the system of municipal inspection be given a trial, but that if after a test for a year or two it was found ineffective, then a special bill should be drafted to empower the Department of Agriculture to appoint inspectors. This recommendation was made in the Board's report of 13th August, 1900, and as it is now on its fourth year's trial some idea can be gained of its value.

There are in Victoria 104 municipalities which furnish dairy produce in quantity for export. For the purpose of shewing to what extent these municipalities have gone towards the achievement of the Board's standard, four separate classes are described :—

First.—Those adopting a system of combined inspection and instruction calculated to raise the quality of dairy products to the highest possible standard of excellence.

Second.—Those administering a system in accordance with the requirements of the Health Act, and under this class there are municipalities which according to the degree of success attained may be divided into three grades, namely :—1st. Those which have secured considerable improvement. 2nd. Those which have obtained fair results. 3rd. Those which achieved very little, although their machinery (rules, etc.) was as complete as that of those which did a deal of good.

Third.—Those which nominally complied with the requirements of the Health Act—that is those that levy and collect registration fees and appoint inspectors without salaries, or only nominal salaries, and who have done practically nothing.

Fourth.—Those which are making no pretence of doing anything.

FIRST CLASS.—Nil.

SECOND CLASS.

FIRST GRADE.

Belfast Shire	Hampden Shire	Warrnambool Shire
Colac ,,	Koroit Borough	

SECOND GRADE.

Alexandra Shire	Glenlyon Shire	Port Fairy Borough
Bacchus Marsh Shire	Heytesbury Shire	Rodney Shire
Barrabool Shire	Mansfield ,,	Seymour ,,
Benalla ,,	Mortlake ,,	Traralgon ,,
*Broadford ,,	McIvor ,,	Wyndham ,,
Buln Buln ,,	Narracan ,,	Yackandandah Shire
Buninyong ,,	Orbost ,,	Yea Shire
Euroa Shire	Oxley ,,	

THIRD GRADE.

Alberton Shire	Frankston & Hastings Shire	Phillip Island and Woolamai Shire
Avon ,,	Gisborne Shire	Rosedale Shire
Bairnsdale ,,	Lilydale ,,	Wannon ,,
Cranbourne Shire	Maffra ,,	Warragul ,,
Dandenong ,,	Metcalfe ,,	Winchelsea ,,
Dundas ,,	Mornington ,,	
Flinders & Kangerong Shire	Poowong & Jeetho Shire	

* Broadford Shire has recently dispensed with their Dairy Inspector's services.

THIRD CLASS.

Beechworth Shire	Marong Shire	Romsey Shire
Bellarine ,,	Merriang ,,	Rutherglen Shire
Berwick ,,	Minhamite ,,	Shepparton ,,
Corio ,,	Morwell ,,	Strathfieldsaye Shire
Chiltern ,,	Mount Franklin Shire	Towong ,,
Echuca ,,	Mount Rouse ,,	Tungamah ,,
Kyneton ,,	Portland ,,	Wodonga ,,
Lancefield ,,		

FOURTH CLASS.

Ballan Shire	Kerang Shire	South Gippsland Shire
Borung ,,	Kilmore ,,	Springfield Shire
Bright ,,	Korong ,,	Stawell ,,
Bulla ,,	Maldon ,,	Talbot ,,
Bungaree ,,	Meredith ,,	Tambo ,,
Deakin ,,	Mirboo ,,	Tullaroop ,,
East Loddon Shire	Newham United Shire	Violet Town ,,
Glenelg ,,	Newstead ,,	Waranga ,,
Gordon ,,	North Ovens ,,	Wimmera ,,
Goulburn ,,	Numurkah ,,	Woorayl ,,
Healesville ,,	Omeo ,,	Yarrawonga ,,
Huntley ,,	Pyalong ,,	

No local body realises the requirements of the specification in the first class. Five municipalities reach the standard of the first grade in the second class; twenty-three the second and nineteen the third grade of the same class; twenty-two come under the third, and thirty-five in the fourth class.

Last year, those local bodies paid £2,907 to 55 inspectors, but some appointments are filled by officers who receive no additional pay. The total amount collected was £3,391.

Under the impression that the levying of dairy registration fees and the appointment of inspectors were compulsory, the system was in many cases nominally adopted, although local administration was not believed in. For instance, the Shire of South Gippsland, one of the largest dairying municipalities in the State, appointed an inspector last year at a salary of £90, then three months leave of absence without pay was given him, followed by three months more, and finally, when it was found that no action was taken for non-compliance with the Act, the appointment was cancelled.

Violet Town also appointed a dairy inspector and afterwards suspended the carrying out of the regulations for twelve months, and at the end of that time dismissed him.

Ballan, Waranga, and Woorayl gave it a trial in addition to other Shires for a period but have discontinued it. The last to secede from the local system was Pyalong, and a number of others have under consideration at the moment the abolition of local inspection.

In practice, many serious obstacles to success were encountered. The pressure brought to bear by some careless but influential dairymen was the greatest difficulty.

In many instances, inspectors were appointed who had no knowledge of dairying or the requirements of the industry, and dairymen consequently took little notice of recommendations made by them.

Perhaps the greatest bar to general compliance with this system, was that it lacked the chief element required to make it acceptable to the dairymen and a benefit to the dairying industry, namely, instruction. The only point aimed at was improvement to yards, sheds, dairies, in some instances; and sanitary arrangements; but the losses encountered through keeping milk and cream in dirty and unsuitable utensils and surroundings, and for long periods at high temperatures before delivery at the factory, were not pointed out nor remedies suggested. The use of biestings was not taken exception to.

In short, the duty devolving on the municipality, was to comply with the obligation thrust upon them by the Health Act.

In numerous instances, municipal officers—secretaries, engineers and rate collectors—are appointed as dairy inspectors, who, owing to the pressure of other duties, can devote little or no time to the work of dairy inspection; whilst commission agents whose business naturally is of a nature to prohibit them from conscientiously performing their duties are also appointed.

Policemen, in some instances, are engaged, but the remuneration offered is usually inadequate to create an interest in the work, and the inspection is invariably an accidental one, that is to say—dairymen on one's beat through the district would come under supervision more than those in out of the way places. In short, the whole of the system lacks uniformity. Each inspector carries out his duties according to environment and previous training, hence in some cases, very little benefit is derived from such inspection.

Another great difficulty lies in the fact that some municipalities have done nothing and do not intend to take any move. In such cases it is very difficult for dairymen to adopt improved methods, whilst across the fence is another man supplying milk to the same creamery who is exempt from any such control. They cannot help thinking a hardship is inflicted on them by having to pay registration fees and conform to inspection. A number of letters received recently from all parts of the country, describe this as nothing more or less than class taxation.

Mr. James McKenzie, Chairman of Directors of the Yarram Butter Factory, states that only sound legislation and expert supervision will ever place the industry on a strictly commercial and highly prosperous foundation.

Mr. S. Giblett, Dairy Inspector, Shire of Narracan, writes:—"Of the four Shires adjoining Narracan three have dispensed with their inspector, and in the fourth their engineer acts—that is, he sends out notices to pay the fee. Now some good results have been achieved in our Shire, but with such influences around one, the work was much retarded."

Another correspondent says:—"Proper supervision would be gladly welcomed, and the inspector should first inspect the cases at the factory, and where uncleanliness exists should go straight to the individual responsible for it and deal with him."

The following was received from another man interested:—"I know that the inspection in this district is to all intents and purposes no inspection at all. The inspector has no practical knowledge of dairy matters at all, and does not trouble the farmers with his presence very much. The good farmers particularly are complaining of this laxity. I frequently find farmers sending inferior cream to the factory, just through ignorance of the proper methods of handling and conditions of surroundings likely to injure it. Many are anxious to be put on the right track, and it requires a skilled man to go round and visit farms and give practical instruction."

Another dairyman writes that municipal inspection is popular in his Shire, because, from various causes, it ceases to be inspection except in name. The suppliers want instruction to enable them to improve their butter or else they will go behind now with strong competition from other countries.

Writes another:—"I would not care to write down all I know about dairymen in our district, but very bad cream arrives from some of the farms, an inspection of which would soon satisfy anybody that something was radically wrong and plenty of room existing for instruction. The dairymen put the blame of almost everything on the separator machine. I enclose letter from one who sent in some very bad cream, saying that the cream was not what he would like it to be as his machine was in very bad order and some of the parts were worn out. Another letter I send is from a dairyman who says that the speed of his machine is correct and it runs smoothly; he cannot understand why his cream should be bad."

Another man writes:—"I consider that without the power to enforce any recommendations the inspector may make, it is only a matter of class taxation for the farmer to have to pay salary without deriving any benefit. Although inspection has been the means of improving the use of the home separator, I don't think it has improved our butter. The home separator is a great encourager of careless ways to some farmers, such as dirty milking, no straining, putting milk through that would be rejected at creamery, not delivering often enough, and carelessness in transit to the station, having no covering in hot weather. Until you can impress the farmer by instruction there will not be much done for the bettering of the butter industry."

It is more than likely that the Health Act 1890, from which the Municipal Councils derive their powers, was enacted without much consideration being given to the influence it would have on the quality of dairy products for export, the main desire being that the wholesomeness of that portion produced for local consumption should be ensured—especially city milk supplies—it being considered of trivial importance whether butter commanded top price or twopence below that figure, as long as it was not injurious to the health of the consumer. Very little butter was being exported then, and even with regard to that little it is improbable that the health of consumers abroad was being considered. The welfare of the dairying

industry was not catered for as fully as it should be with a view to improving the quality and increasing the money value of the product.

However, if it were necessary to provide for inspection when butter was only a by-product of the farm, how much more so is it now that it has grown into a staple industry and that our products have to compete in the world's markets with those of other countries which have thorough systems of inspection in operation.

Ever since the inception of the export trade the Department of Agriculture has been most sympathetic for the welfare of the dairying industry and those engaged in it. In bonuses for the establishment of factories, creameries, the exporting of butter, and instruction, nearly £150,000 has been given. The sound instruction disseminated by the late Mr. David Wilson helped producers greatly, the industry was launched on solid up-to-date lines, and for some years rapid headway was made both as regards quantity and quality. In those days every factory and creamery manager exercised a certain amount of influence for good over the suppliers, almost all of whom he came in contact with daily. The factories and utensils were then comparatively new and uncontaminated. With the advent of the home separator, producers were withdrawn from the factory managers' control, and the nature of the competition that exists for cream tended to carelessness and a lower standard of quality. The present Minister of Agriculture, Mr. Taverner, many years ago recognised that with the growth of the industry, the alteration in the methods of treating milk and cream, and the inclusion in it of producers who had no previous experience or training, care and instruction became increasingly necessary; consequently he appointed your humble servant, and at a later period Mr. H. W. Potts, the extent of whose labours is well known. The dairymen of the State are also deeply indebted to the Agricultural Department for the services of Dr. Cherry, R. T. Archer, and P. J. Carroll, and no instance has yet been recorded of those in the industry having been harassed or discouraged by those officers. Hardly a week passes by without grateful recognition being received by the Department for help and advice given to dairymen. All along, however, one great drawback has been experienced, namely, power to deal with those few who will insist on doing that which results in injury to their neighbours, and harm to the dairying industry. Authority is badly needed to stop the use of biestings for butter-making purposes whether the product is for export or not. Every practical dairyman is aware that a good keeping butter cannot be made out of milk from newly calved cows for some days after calving, and yet in spite of this knowledge there are a few who, to gain a few pence at the moment, do not scruple to deprive their neighbours of pounds by bringing down the reputation and price of butter abroad.

Then, again, power is urgently wanted to enforce the discontinuance of rusty and unsuitable vessels for use with milk and cream.

With the great majority of dairymen compulsion is entirely unnecessary, but in their interests the power is required to deal with

the small proportion in every district who are not inclined to be either careful or clean.

It is disheartening to have to make recommendations again and again and support them with sound contentions and still, after getting promises of the adoption of remedial measures, to come back in a short time and find the same state of affairs existing.

There are many details which require attention, but the few mentioned should suffice to show the need for more weight accompanying instructors' recommendations, not that the law would be required for actual use except in exceptional and defiant cases. If administered by the Agricultural Department it is not likely that harsh measures will be resorted to, except and only when the export trade is imperilled.

INSTRUCTION IN CHEESE-MAKING.

By R. T. Archer.

Early last year instructions were received from the Director of Agriculture to devote my attention particularly to the improvement of the quality of cheese produced in Victoria, and my first step was to visit the agents and salesmen in Melbourne to ascertain who were the most in need of attention, and from this source a long list was obtained. In the meantime there were numerous applications for my services, and these were attended to in order of application or urgency.

A great number adhere to the American or stirred curd system, and to this is due the greater quantity of inferior cheese placed on the market. It is almost impossible to make cheese of as uniformly good quality by that as by the Canadian Cheddar system as too much is left to judgment, taste and smell, proficiency in which can only be obtained after many years of practical experience and study, whereas the Canadian system is practically a certainty provided the given rules and tests are adhered to, and by which a novice can attain success in a few weeks and make a more uniform article than others with years of experience on the old system. A notable instance of this is the manager of the Farnham factory, Mr. Ryan, whose cheese, his Melbourne agents state, is equal to anything coming into the market and has been from the commencement, which is the result of a fortnight's tuition at the start, and is practically due to the regular use of the titration test for acidity, which was fully described in an article in the *Journal* in June, 1902, and which was first introduced by me into this State in connection with cheese-making. When this test is thoroughly understood, and it is very simple, its use will prevent many of the errors into which cheese-makers fall, especially before they have had considerable experience.

Several factories continue to pay for the milk, at per gallon, a uniform rate irrespective of quality, a practice discarded by the leading factories 12 or 13 years ago, since it really offers a premium for dishonesty by adding water or skimming. Many cheese-makers are under the impression that milk poor in butter fat is more suitable for cheese-making than that rich in butter fat, the error of which was pointed out in my reports to the Wangerrip and Lower Gellibrand Cheese Factories and others, giving the following tables as evidence of this.

TABLE SHOWING RELATION OF FAT IN MILK TO YIELD IN CHEESE.

Group.	Per Cent. of Fat in Milk.	Pounds of Green Cheese made from 100 lbs. of Milk.	Pounds of Green Cheese made from 1 lb. of Fat in Milk.
1	3 to 3·5	9·14	2·73
2	3·5 ,, 4	10·04	2·70
3	4 ,, 4·5	11·34	2·75
4	4·5 ,, 5	12·85	2·71
5	5 ,, 5·25	13·62	2·66

Professor Van Slyke, in a series of investigations extending over several years and including the milk of not less than fifteen hundred different cows, found that the percentage of casein increased in a nearly constant ratio with the percentage of butter fat. To quote his own words, "While we have noticed considerable variation when we consider individual herds, we have found that, as a rule, there were two-thirds of one pound of casein for each pound of fat in milk, whether the milk contained 3 or 4 per cent. of fat, though this normal relation was considerably affected in the season of 1893 by the effects of drought upon the pasture, in which case when the amount of fat in the milk increased beyond 4½ per cent. there was a gradual but slight diminution of casein for each pound of fat."

A similar case was brought under my notice with regard to a cheese factory in North Gippsland last year, in which milk of a certain percentage of fat would not produce quite so much cheese as milk of the same percentage of fat in a factory within a few miles. With reference to this, Professor Farrington of the Wisconsin Agricultural College wrote that they had similar experience in case of drought when the cows had not sufficient nutritious food, and this was really the cause of the difference. However this does not discount the necessity for paying for milk according to its fat contents, but shows that cows should have plenty of nutritious food to produce the best results.

One of the best means of obtaining proficiency in cheese-making is to keep a daily log, with which all my pupils are started. It enables them to compare one day's make with another, and should they have any cheese which matures differently to the others they may look up the record to see the cause and know how to guard against it another time. The following is a copy of the details of the log :—

Date.	No. of Vat.	Lbs. of Milk.	Colour (1¼ per 1000.)	Rennet (4½ oz. per 1000)	Temp. when set.	Cup Test.	Acid Test.	Set at.	Thick at.	Thick in.
Nov. 29	1	4774	6 oz.	22 oz.	86°	15	·225	9 45	9 57	12 min.

Cut in.	Cut at.	Acid of Whey when cut.	Cooked at.	Cooked to.	First Acid.	Second Acid.	Salt.
30	10 27	·14%	11 18	100°	·18% ⅛ in. 12 18	·45% ¾ in. 1 18	10 lb.

Temp. hooped.	Into Press.	Acid of Whey from Press.	No. of 40 lbs.	No. of 10.	Total Curd.	Ratio.	Remarks.
80°	3 0	·87%	11	4	480	9 79	Good clean curd. Matured well.

To enable us to discover the source of taints in the curd we have introduced what is known as the Wisconsin curd test, which consists of a number of pint glass jars which are nearly filled with milk, a separate bottle being used for each supplier, the milk is heated to 98 degrees Fahr. coagulated with 10 drops of rennet, cut in 20 minutes, and the

whey drained off as it separates, the temperature being kept up to 98 degrees by standing the jars in water at this temperature. At the end of six hours or more the lid is removed, and by the odour and texture of the curd in the jar we can tell immediately which was the milk that caused the trouble. The principal cause of trouble is due to carelessness in milking, and the neglect to properly cool the milk. If farmers would adopt the Laurence cooler there would be a great improvement in the condition of the milk delivered at the factory. The same applies to farmers treating their own milk. The Laurence cooler aërates and cools the milk at the same time, and one has only to taste the milk before and after running over the cooler to be convinced of this. Another cause of trouble is the use of cheap thermometers. Scarcely one in a dozen is correct. Some in use are as much as 8 degrees Fahr. too high, which means that when the cheese-maker thought he was cooking to 100 degrees he was really only cooking to 92 degrees, and often there is a variation of two or more degrees between 86 and 100 degrees. A test thermometer should always be kept with which to try the cheap ones, and can be obtained for from 3s. 6d. to 4s. 6d.

There is a good deal of ignorance as to the proper time to run off the whey and when to mill or grind the curd, but this should not be if the cheese-maker will make himself acquainted with the tests for acidity, and success or failure depends mainly upon the development of the proper percentage of acidity at the different stages of the work.

A list of the places that have been visited is attached, and in almost every instance an improvement has been noted as the result of the instruction given.

Warrnambool Cheese Factory ...	Allansford
Mr. Baragwanath's	Agnes River
Toora Cheese Factory	Toora
Woodleigh Cheese Factory	*Via* Loch
Lindenow Cheese Factory	Lindenow
Clifton Park Cheese Factory	Bairnsdale
Mr. McLeod's Factory	Hillside
Mr. McInnes' Factory	Weeaproinah
Lower Gellibrand Cheese Factory ...	Princetown
Princetown Cheese Factory	Princetown
Wangerrip Cheese Factory	Princetown
Briagalong Cheese Factory	Briagalong
Messrs. Rogers Bros.	Longwarry South
Farnham Cheese Factory	Dennington
Mr. R. A. Tulloch's	Moyarra
Mr. A. Tulloch's	Moyarra
Mr. A. O'Keefe's	Toora
Mr. Meredith's	Larpent
Grasmere Cheese Factory	Grasmere
Mr. G. F. Syme's	Dalry
Mr. Cropley's	Darnum

Mr. David Mitchell's	Baryarg
Mr. Wade	Traralgon
Mr. David Mitchell's	Cave Hill
Garvoc Cheese Factory	Panmure
Mr. Hancock's	Pomborneit
Mr. Baker's	Pomborneit
Cowwarr Cheese Factory	Cowwarr
Mr. O'Keefe's	Adelaide Vale
Mr. McAdam's...	Toora
Mr. Uren's	Krowera
Mr. H. Cameron	Wimba

BACTERIA AND THE NITROGEN PROBLEM.

By George T. Moore,

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Introduction.

There is probably no fact in plant physiology which has been more firmly established than that all plants must have nitrogen in order to thrive, and that under normal conditions this nitrogen must be obtained through the roots in some highly organised form. It is not necessary to discuss this point, for practical experience demonstrates its truth every time a soil is exhausted by any crop, and the farmer testifies to his belief in this fact when he tries to re-establish the fertility of his ground by adding some fertilizer rich in nitrogenous matter. While there are certain other substances, such as phosphoric acid, potash, iron, etc., which plants must have and can only obtain through the soil, the demand for nitrogen is so much greater and in one sense so much more important, that the question of the available nitrogen supply in the world has come to be looked upon as lying at the very foundation of agriculture and demanding the most careful consideration. Since the conditions of life in the civilized quarters of the globe are such as to cause a constant loss of nitrogen, there have been some who have predicted what has been termed a "nitrogen famine," which is to occur within the next forty or fifty years, and the possibility of such a catastrophe has been very graphically portrayed. On the other hand, there are investigators who feel that the possibility of such a condition has been much exaggerated and that the amount of nitrogen in the soil can never be exhausted to such an extent as to affect the crop-producing power of the earth. In order that we may be able to form a more definite opinion upon the subject, it may be well to look at some of the ways in which nitrogen is lost, and then see how it may be reclaimed.

How Nitrogen is Lost.

In the first place, the conditions of life on the ordinary farm are such as to cause the constant loss of this valuable element through the removal of the crops taken from the soil. If every crop that grew on the land could be returned to it, nature has made provision for getting it back in suitable form for plant food. In the case of nitrogen neither plants nor animals are able to produce this substance directly in an available form. It is necessary that certain bacteria take hold of plant and animal products, and by means of peculiar changes produce nitrates from their fats, sugars, starches, etc. Without these bacteria everything would have come to a standstill long

ago, for unless decay takes place and the decomposed elements are rearranged into definite nitrogenous salts no plant is able to use them. Thus it will be seen that certain bacteria in the soil play as important a part in the food supply of the earth as do the animals and larger plants upon which we think we are so dependent.

It is hardly necessary to refer to the vast waste of nitrogenous material that is involved in modern sewerage methods. Millions of dollars' worth of nitrogen which would naturally return to the soil under the action of nitrifying bacteria is every year carried off in various waterways and ultimately reaches the ocean, where, of course, it is of no benefit to man. More than fifty years ago Liebig said on this subject:—

> Nothing will more certainly consummate the ruin of England than the scarcity of fertilizers. It means the scarcity of food. It is impossible that such a sinful violation of the divine laws of nature should forever remain unpunished, and the time will probably come for England, sooner than for any other country, when with all of her wealth in gold, iron, and coal she will be unable to buy the one-thousandth part of the food which she has during hundreds of years thrown recklessly away.

A third great source of nitrogen loss is through the action of a group of bacteria which have the power of breaking down nitrates, depriving them of oxygen, and reducing them to ammonia or nitrogen gas, when they are, of course, unavailable for plant food. This process of denitrification, while very useful in the septic tank, which is the most sanitary method of sewage disposal, is the source of considerable loss to the farmer, and manures may often be rendered practically worthless by the action of these bacteria.

Other means by which nitrogen is lost so far as plant foods are concerned, are the washing out of nitrogen salts from the soil and the burning of explosives which are largely composed of some nitric salt that would be directly valuable to the vegetable kingdom. The action of nitrate of soda, or saltpeter, has been studied experimentally, and it is known that up to a certain maximum about 23 pounds of nitrate of soda will yield an increase of 1 bushel of wheat per acre. Thus, when hundreds of thousands of tons of explosives are used in waging war, every battle liberating nitrogen which, if applied to the soil, would increase the yield of wheat by thousands of bushels, the actual cost of war should be estimated at considerably more than is usually calculated; and if there is soon to be a nitrogen famine, war becomes more serious than ever before.

With all of these destructive forces at work and nitrogen being liberated on every hand, it is no wonder that thinking men have become alarmed at the prospect, and have endeavoured in every way possible to discover some means of increasing the world's supply of this most necessary element.

How Nitrogen is Gained.

The most valuable compound containing sufficient fixed nitrogen to be used in any quantity as a nitrogenous fertilizer is the nitrate of

soda, already referred to as the basis of so many explosives. This salt occurs naturally in certain regions of Chili and Peru, where for countless centuries the continuous fixation of atmospheric nitrogen has been carried on by bacteria. Unfortunately, however, like any other mineral supply in the earth, the quantity is limited, and although it is difficult to get accurate estimates of the amount of nitrate remaining in the beds, authorities seem to agree that at the present rate of export the raw material will all be exhausted within from forty to fifty years. To show how much more rapidly this supply is being exhausted than was thought possible forty years ago, it is only necessary to state that in 1860 all estimates showed that the amount of nitrate of soda then known would last for nearly fifteen hundred years. The demand has rapidly increased, however, and although the output is controlled, there is annually consumed in the world's markets nearly 1½ million tons of nitrate of soda, representing a value of about $100,000,000. Of this amount, the United States requires about 15 per cent., and it is by far the most expensive fertilizer that is in use by the farmer.

In addition to the nitrate of soda beds there have also been large deposits of guano, which have served as one of the principal sources of nitrogen. The greater part of the guano beds are now completely exhausted, however, and although new deposits are occasionally discovered, they are of such limited area, or of such a low percentage of nitrogen, as to have practically no effect upon the available nitrate supply.

There are certain other chemical salts which furnish a limited amount of nitrogen, such as the product which remains from the distillation of coal in the process of gas making, but all of them are obtained in such comparatively small quantities that they are not worth taking into consideration when one realizes the enormous amount of nitrogenous fertilizer necessary to replace the combined nitrogen which is annually removed from the soil in one way or another.

Ever since the importance of increasing the combined nitrogen supply has been realized, men of science have naturally turned to the atmosphere as being the most promising field for experiment and the one most likely to eventually solve the whole problem. When it is remembered that nearly eight-tenths of the air about us is nitrogen, and that plants are able to obtain their entire source of carbon from a gas which is present in the comparatively small proportion of one-tenth of one per cent., it seems almost incredible that there should be any more difficulty about a plant's nitrogenous food than about its supply of carbon dioxid. Since it seemed so well settled, however, that plants could not use nitrogen as a gas, the chemists and physicists have made every effort to devise some mechanical means of making this element available in a combined form. It has been known that discharges of lightning passing through the air are able to fix free nitrogen, and, beginning with this as a basis, some very satisfactory results have been obtained by the use of electricity.

With a power sufficiently cheap and with perfect machinery, there seems good reason to believe that in the near future it will be possible to place upon the market a manufactured nitrate of soda or nitrate of potash that will be superior in quality to the deposits found in South America, and that will also be reasonable enough in price to compete with the natural product.

Nitrogen-Fixing Bacteria.

Fortunately, there are still other means by which nitrogen gas may be made available for plant food, and that, too, without requiring the introduction of a commercial product, which must always be rather expensive, whatever degree of perfection may be reached in the mechanical operation of the process. Ever since the earliest days of agricultural science it has been noticed that certain land, if allowed to stand fallow for a considerable length of time, would gain in nitrates without any visible addition having been made. It is now known that one of the principal means of this increase in nitrogen content is due to a few forms of soil bacteria which have the power of fixing the free nitrogen from the air and rendering it available for plant food. These organisms have been isolated and cultivated artificially, and great hopes were held at one time that it would be possible to inoculate land with these cultures and thus bring about a large increase in the nitrogenous salts without the aid of any manure or mineral fertilizer. Under certain conditions these bacteria seemed able to do a large amount of work, and there are experiments on record where the crops raised from plots inoculated with nitrogen-fixing organisms were much greater than crops from uninoculated land. Unfortunately, these results were not always constant, and such a large percentage of failures had to be reported that from a practical standpoint the use of such cultures is now considered worthless. A matter of such vast importance to agriculture, however, should not be neglected simply because of first failures. It is quite possible that as we become better acquainted with the habits of these bacteria and learn the conditions which are most favorable to fixing nitrogen and the causes which prevent this operation from going on at all times, we shall be able to discover some means of using these nitrogen gatherers in practical farming.

Root Tubercle Bacteria.

In the meantime there is still one other means at hand which can be used and has been used for countless centuries as a most efficient method of conserving the world's nitrogen supply. Ever since the time of Pliny and other early writers upon agricultural topics, it has been known that certain leguminous crops, such as clover, beans, peas, etc., did not require the same amount of fertilizer as other plants, and indeed it seemed as though they actually benefited the soil instead of being a detriment. Various theories have been advanced to account for this effect, perhaps the most widespread

opinion being that members of this family, owing to the unusual length and strength of their root system, were able to draw upon a store of food that was not available to wheat and corn and other crops not belonging to the pod-bearing group. It is only within a comparatively recent time that the real cause of the beneficial effect of these legumes has been fully understood, and it seems that here again the bacteria are responsible for the nitrogen-gathering power; for it is because these plants are able to fix and use the free nitrogen of the air that they are of such benefit in rotation and in reviving poor and exhausted land. The immense yields of wheat following alfalfa or clover are easily understood when it is realized that there has actually been added to the soil a certain definite amount of nitrogen in such form that the wheat can be benefited by it. Such efficient users of the atmospheric nitrogen are clover and peas and similar crops that they can actually live and thrive in a soil that has not the first trace of combined nitrogen within it. If quartz sand be ignited to red heat, thus burning out all the nitrates, and then be planted with peas or beans, it is possible to bring these plants to full maturity without in any way allowing a particle of fixed nitrogen to find its way into the soil. On the other hand, wheat or potatoes, or crops not legumes, will die as soon as the small amount of nitrogen available from the seed is exhausted. What is the reason for this? It can not be merely a difference in the length or extent of the root system, because plants flourish where it is certain there are no available nitrates whatever. For a long time the presence of certain peculiar nodules or tubercles upon the legumes has been noted and speculated upon. These formations are always present upon the roots of leguminous plants grown under proper conditions, and may vary in size from that of the smallest pin head, in some clovers, to a cluster as large as a potato. They have been thought to be due to the bites of worms or insects, or to be caused by conditions of the soil and various abnormal climatic effects, and only within very recent years has it been learned that these formations are due to the presence of innumerable bacteria, and that unless these tubercle-producing bacteria exist the plant is no more able to use the nitrogen from the air than wheat or any of the other crops which do not have such nodules on their roots.

Microscopic Appearance of Tubercles.

Just where the nitrogen is fixed and how it is used by the plant have been debated questions. Some have supposed that the presence of the bacteria in the roots simply acted as a stimulus, and that the leaves of the plant were thus able to take in nitrogen as a gas and to elaborate nitrates from it in some such way as carbon is formed from carbon dioxid. It seems much more probable, however, that the bacteria themselves fix the nitrogen in the roots of the plant and that it is then used as nitrates would be used from the soil. It is certain that these tubercle organisms can fix free nitrogen in cultures, and there is no reason to suppose that this power is lost when within the

roots of a legume. Furthermore, it seems as though the plant actually uses the contents of these tubercles, for at the end of the season the tubercles are found to be much softer and shrunken, and are practically emptied of their mass of bacteria.

Effect of Tubercles.

It is a well-established fact, and has been shown by a number of independent investigators in various parts of the country, that the leguminous crop which bears tubercles will exceed a similar crop without tubercles by from 100 to 1,000 per cent; that is, a field of clover grown on such poor soil that it would only yield 200 pounds to the acre would be so invigorated by the presence of tubercle-forming bacteria that on exactly similar soil it would produce from 400 to 2,000 pounds to the acre, and this without any cost whatever for fertilizers and with very little more labor. In addition to the increase of the actual weight of the crop, tubercles also cause the plants to flower and fruit earlier, and the number of seeds produced is very much greater.

Thus it will be seen that it is worse than useless to attempt to grow any leguminous crops without being certain of the presence of the bacteria which enable the plant to fix free nitrogen. It would be much better to fertilize heavily and attempt to raise some more profitable crop than to introduce clover or beans or some other legume for the purpose of enriching the soil. It can not be too strongly emphasized that unless the tubercles are present the leguminous crop is of absolutely no more benefit to a soil than wheat or potatoes.

While these organisms are pretty generally distributed throughout the earth, and it is quite possible in many parts of the country to grow almost any leguminous crop and secure these tubercles, it is also true that certain regions are practically devoid of the right kind of bacteria, and that unless some artificial means of introducing the germs be resorted to the crop will be a failure.

Artificial Inoculation of the Soil.

In the past there have been two methods used in attempting to bring about artificial inoculation. Naturally where a certain leguminous crop has been grown successfully for a number of years the soil will become filled with tubercle organisms, and by transporting this earth to new fields the organisms will thus become available for forming the nodules in localities where they previously had not existed. This was the means by which the soy-bean organisms were brought from Japan, and there are very few places in this country where soy is now grown that did not receive their inoculation, indirectly at least, from the Japanese soil.

There are two serious objections to soil inoculations, however. One is the expense, for it requires anywhere from 500 to 1,500 pounds of earth per acre to produce a satisfactory growth of tubercles, and if

this has to be transported for a large farm, the cost is almost prohibitive. There is still another and more serious objection, however, and that is the danger of transmitting plant diseases by this method. Several of the more serious diseases which attack crops are readily conveyed in the soil, and there are numerous cases on record where diseases of leguminous and other crops have been introduced into regions previously entirely free from them through an effort to bring about a soil inoculation of the tubercle-forming organism. Consequently, if any safer and cheaper method could be devised for making these germs available, it would be most desirable.

A few years ago certain German investigators put upon the market a product known as nitragin, which purported to be a pure culture of the root-tubercle organism. These cultures were only adapted to specific crops, for it has been held that each kind of leguminous plant had a special germ better adapted to produce tubercles upon it than any other form, and for this reason it was necessary to use one organism for clover, another for peas, and so on. This preparation, nitragin, has been used with varying success abroad. Some experiments seemed to show that it was of the greatest value, while others were complete failures in demonstrating its worth. The failures so far outnumbered the successes, however, that its manufacture has been abandoned, and it can no longer be obtained. A few attempts have been made to use these cultures in this country, and while some very satisfactory results were obtained, the number of failures was even greater than abroad, the varying conditions involved in transportation and the length of time which elapsed before the germs could be used being fatal to about 80 per cent. of the material imported.

Improved Method of Inoculation.

A little more than a year ago the investigation of these nitrogen-fixing bacteria was begun in the laboratory of plant physiology of the Bureau of Plant Industry, with the hope of discovering some method of artificially inoculating soils which were devoid of the proper organisms, and of insuring their producing the desired result. It was soon found that the method in use by the German investigators was not adapted to the life of the organism; that is to say, the use of rich nitrogenous food material, such as decoctions of the host plant, were not calculated to produce an organism which would fix free nitrogen from the air. It was found that while the bacteria grew luxuriantly upon such media, they became less and less active, until eventually they lost completely this nitrogen-fixing power. It seemed as though the large amount of nitrates in the media upon which they were grown made it no longer necessary to draw nitrogen from the air, and consequently they deteriorated until they became of no more value than the common soil forms. It has been found, however, that by gradually reducing the amount of nitrogen in the culture medium it is possible to greatly increase the nitrogen-fixing power of these germs, and that by proper manipulation their activity may be in-

creased from five to ten times that which usually occurs in nature. Practical field experiments have shown that of two cultures, one grown on nitrogen-free media and the other on a medium rich in nitrates, the first will produce abundant tubercles, while the latter will be absolutely worthless and fail to produce a single nodule.

Distribution and Methods of Use of Cultures.

Having secured an organism which was able to fix such a large amount of nitrogen, it was necessary to devise some means of preventing this property from being lost, as well as to enable the cultures to be distributed in sufficient quantity to be of some practical use. It is now known that the bacteria, when grown upon nitrogen-free media, will retain their high activity if they are carefully dried out and then revived in a liquid medium at the end of varying lengths of time. By using some absorbent which will soak up millions of the tubercle-forming organisims and then by allowing these cultures to become dry the bacteria can be sent to any part of the United States, or the world for that matter, and yet arrive in perfect condition.* Of course, it is necessary to revive the dry germs by immersion in water, and with the addition of certain nutrient salts the original number of bacteria is greatly increased if allowed to stand for a short time. Frequently twenty-four hours are sufficient to cause the water in a pail to turn milky white with the number of organisims formed in that time. Thus, by sending out a dry culture, similar to a yeast cake and no larger in size, the original number of nitrogen-fixing bacteria may be multiplied sufficiently to inoculate at least an acre of land. The amount of material thus obtained is limited only by the quantity of the nutrient water solution used in increasing the germs. It is evident, therefore, that the cost of inoculating land is very small. The principal cost is in obtaining the organisms, but the methods perfected by the Department of Agriculture now make it possible to produce these at a comparatively small cost. Special facilities for increasing the culture on a large scale are being provided.

The way in which this liquid culture may be introduced into the soil varies somewhat with the character of the seed to be used and the area of the field to be treated. With large seeds it is often more convenient to simply soak them in the fluid and then after they are sufficiently dry to sow them in the ordinary way. In other cases it is frequently more feasible to introduce the liquid culture directly into the soil. This may be done by spraying, or perhaps a simpler method is to mix the culture thoroughly with a wagonload of earth and then to distribute and harrow this in just as a fertilizer would be handled. Inoculations of this character have been tried on a large scale in practical field experiments, and the results have been so satisfactory that the Department of Agriculture will probably soon be able to begin the introduction of cultures into such localities as are now deficient in

* The Vegetable Pathologist has communicated with Mr. Moore, with a view to securing a supply of the cultures. [Ed. *Journal.*]

tubercle-forming germs. It should be borne in mind that such inoculations are usually not necessary in soil that is already producing tubercles. While the introduction of fresh organisms will generally considerably increase the number of nodules, the effect upon the crop is not appreciable, and it is hardly worth the expenditure of time and labor necessary to make the inoculation. Wherever legumes that fail to produce tubercles are being grown, however, or in those localities where the soil is so poor that legumes will not grow and because of the lack of the proper organisms they can not make a start, every effort should be made to get the bacteria into the soil.— [*Year Book of U.S. Department of Agriculture, 1902*].

VARIETY TESTS OF WHEAT, OATS, AND BARLEY.

By D. McAlpine.

During the past season a number of important experiments were carried out, and the results of those relating to cereals are now recorded as far as available, in order that the information gained may be placed at the disposal of the farmer as early as possible. These experiments were conducted in different districts, so that due allowance might be made for varying conditions of soil and climate, and were spread over a wide area, including Port Fairy, Rutherglen, Leongatha, Nagambie, and Myrniong.

The testing of varieties of wheat, oats, and barley has been continued, and this has included, for the first time, the celebrated Garton varieties. These were introduced by the Director of Agriculture, and the more promising varieties will receive further attention during the coming season.

Not only were Gartons new and improved breeds given a trial, but a number of varieties of wheat, oats, and barley were sent from the United States Department of Agriculture by M. A. Carleton, Cerealist in charge. We desire to cordially thank that Department for the generous manner in which they invariably accede to our requests. The varieties sent were accompanied by the following note:—" We would not for a moment guarantee that all of these or any considerable proportion would prove to be satisfactorily rust-resistant. A number have proved so in this country, and we consider all very good varieties, either for rust resistance, drought resistance, or for hardiness in other respects. A number of these are *durum* varieties, called generally in this country macaroni wheats. As you know, these are almost uniformly rust-resistant; though, of course, not at all rust-proof, and even the *durum* varieties we have found quite susceptible to the stem rust, *Puccinia graminis*, in this country, when this rust occurs in considerable quantities."

Mr. Farrer, Wheat Experimentalist of New South Wales, likewise forwarded a few of his cross-breds, and these, with a few retained from the previous year for trial, make up the number of varieties tested as follows:—Wheats, 28; oats, 12; barleys, 10.

1.—Port Fairy.

The Single Seed Plots were sown on 15th July in volcanic sand in which potatoes had been grown the previous year, and treated with farmyard manure at the rate of about 25 tons to the acre. The rainfall was above the average, being 32·62 inches for the year, and averaging 28·43 inches on a sixteen years record.

Gartons cross-breds.—The wheats were all very late, and some of them badly rusted. New Era was the only wheat considered worth

retaining, for though it was very late it stooled well and the bearded ears were very long, up to seven or eight inches. The flag was rusty but the straw was comparatively clean.

The oats were likewise very late, but Abundance was the earliest of all and the only one retained.

Of the barleys tried they were all rather late, but No. 2 six-rowed barley, grown in a patch as well as in the Single Seed Plots, was further advanced than the rest and consequently retained. It is absolutely necessary to have an early barley for this district, in order to escape the caterpillars, which are very prevalent. This variety is very thin-skinned, and likely to prove a good malting barley.

American varieties.—These were all evidently too late for this district, and besides some of them were very rusty.

Farrer's crosses, etc.—John Brown was tried but it was too late and too rusty to be retained. Bobs was sown on a patch of over 1-40th of an acre and turned out well. It is a little late and a poor stooler, but it is upright and wiry, with good grain. The rust is mainly on flag, and there is a comparatively clean straw. About three acres were sown with Rerraf at the latter end of June on the Blackwoods, where the black soil is subject to floods and the conditions particularly favourable to rust. The land was not manured, but mangels had been grown the previous season, which received a manuring of 2 cwt. Florida superphosphate, 1½ cwt. nitrate of soda, and 1 cwt. salt to the acre. About 80 tons of mangels per acre were harvested. The ground was ploughed to a depth of five inches for the wheat and the seed sown broadcast and harrowed in. The result was a nice clean crop with only a few specks of rust occasionally on the straw, although it appeared on the flag. It stooled and headed well, and the yield will be given later when the wheat is threshed. A crop of Algerian oats growing alongside was badly rusted with *Puccinia graminis* both on stem and flag.

Dart's Imperial was also badly affected, so that it had to be cut for hay. In order to test the effect of late sowing on the development of rust, a small patch of Rerraf was sown under the same conditions late in September. On inspecting this plot on 23rd December the straw was found to be quite clean and only a very little rust on the flag.

2.—Rutherglen.

The soil on which the plots were grown is a light red loam with a yellow clay subsoil, and the previous crop was wheat without manure. The sowing took place on 26th May, under favourable weather conditions.

Gartons cross-breds.—The wheats were all rather late, and for some reason Red King did not germinate at all, so that it will be tried again next season. New Era was the only wheat deemed worthy of further trial. The oats seemed to suit this district better than Port

Fairy, and the majority were considered worthy of further trial. Goldfinder was rejected on account of its being badly rusted, and Pioneer Black was exceedingly late.

The barleys did very well on the whole, and all were retained for further trial. Brewers Favorite was the best, and Gartons No. 1 two-rowed was the least successful.

American varieties.—The wheats were generally late, and some of them were bad with rust. The *durum* wheats were only slightly rusty on flag, and among the promising varieties were the three *durums* from Spain, Algeria, and Italy.

The North Finnish Black oat was the only one sufficiently early in maturing, and although the rust was moderate to bad, it is being tried next season.

Among the barleys two Algerian varieties and one Wisconsin were retained for further trial.

3.—Leongatha.

The sowing of the plots was completed on 15th July, being rather late on account of the wet weather. The soil was a red clayey loam with a northern aspect, and no manure was directly applied. The preceding crop, however, was a very heavy one of sunflowers, for which the land was manured with superphosphate. The total rainfall for 1903 was 43·45 inches, that for 1902 being 33·69 inches, and for 1901 47·42 inches.

Gartons cross-breds.—The only wheat sufficiently promising to be retained was New Era. Red King was very slow in starting to grow, only two plants appearing after being sown more than three weeks, but it will receive a further trial. The oats retained for further trial were Gartons No. 5 and Tartar King; Pioneer, Abundance, and Waverley being good hay oats. The barleys were No. 2 six-rowed and Invincible. This is not a barley district, but if the seed could be well matured it would be very suitable for a change of seed to the northern districts.

American varieties.—The wheats were generally late, and some of them were bad with rust. The *durum* wheats, as a rule, were only slightly rusty on flag, and among the promising varieties were the three *durum* varieties from Spain, Algeria, and Italy. The North Finnish Black oat was the only one sufficiently advanced, and although the rust was moderate to bad, it will be tried next season. Among the barleys two Algerian varieties and one Wisconsin were retained for further trial.

Rerraf was tried on a small scale, but it only made a poor growth and does not seem suited for the district.

4.—Nagambie.

Arrangements were made with Mr. Angus Cameron, of Angustown, for sowing one bushel each of five varieties of Garton oats and barleys, also two and a half bushels of Bobs wheat, from Bathurst

Experimental Farm, New South Wales, and about 20 lbs. of Lot's wheat from the Department of Agriculture, W.A. Generally the sowing was rather late, but the most suitable time will be chosen this coming season.

Gartons cross-breds.—There were three varieties of oats—Nos. 3, 4, and 5—sown on a sandy loam. Some were sown on 25th June, and others as late as 9th July. The only oat worth attending to is No. 5, from which seed will be saved and sown earlier next year.

The barleys, Nos. 1 and 2, were sown on 29th June on ironstone soil. No. 1 two-rowed did well and will be retained.

Other varieties.—Bobs wheat was sown on ironstone soil on 29th June and reaped on 8th December. The straw was nice and clean, stiff and upright, and the ears were well filled. A little rust occurred on flag and it was very slight on stem. Queen's Jubilee was grown alongside and was further advanced, but Bobs seemed better suited to the district.

Lot's wheat is largely grown in West Australia, and was sown in sandy loam on 30th June, but it was too late and too rusty to be retained.

Rerraf was sown on the same day alongside of Lot's, but was much further advanced, and was reaped on 15th December. The straw was generally clean, with rust only on the flag, which did not seem to affect the grain.

5.—Myrniong.

The Messrs. Brittlebank, of Myrniong, have very generously conducted experiments for a number of years with varieties of cereals as well as of grasses and other forage plants. Last season the Garton varieties of wheat, oats, and barley were tried by them, in addition to several varieties retained from previous years.

The land used for experimental purposes is a light soil composed of granitic sand with a mixture of black volcanic soil. The rainfall for 1903 was 27·11 inches, being slightly over the average for 14 years, which was 26·06 inches. The sowing took place on 15th May, just about the right time for this district; but in the case of the Garton varieties, unfortunately, the seed could not be supplied until about a month later. Owing to this late sowing they were destroyed before reaching maturity by caterpillars, but they will be planted in good time this coming season and receive a fair trial. The weather after sowing was exceedingly dry until 15th September, when a heavy rain fell and a general break of the weather occurred.

The varieties of wheat grown and retained from previous years were Queen's Jubilee, Leak's Rust-resisting, Steinlee, King's, Improved Allora Spring, and Rerraf. The only manure applied was a dressing of sulphate of ammonia a few days before sowing.

The wheats generally made good progress, heading early in November and reaching a good height. King's was the first to

ripen, then Allora Spring, followed by Steinlee, Queen's Jubilee, Rerraf, and Leak's. The yields are not yet available but will be given later on. Rust was very prevalent and very severe, so that the susceptibilities of the different varieties were thoroughly tested. King's and Queen's Jubilee were badly rusted, and the others less so. In November, when I examined Rerraf, there was a moderate amount of rust on the flag, and occasionally it was found on the stem. Mr. Brittlebank, in reporting later on the prevalence of rust, states:—"In regard to the rust-resisting powers of the above varieties, there can be no doubt as to Rerraf being placed first. Algerian oats were almost destroyed this year by rust, being the first time since they came into use as a farm-crop in this district, 14 years ago."

New Breeds.

Thanks to the persistent efforts, skill, and enthusiasm of Mr. Wm. Farrer, Wheat Experimentalist of New South Wales, the different States have been put in possession of a number of valuable cross-bred wheats which promise to suit our special conditions, giving larger yields and better grain, combined with hardiness of constitution. For a number of years past we have been favoured by Mr. Farrer with a selection of his most promising cross-breds, and have put them to a severe test as far as their rust-resistance is concerned.

The Garton Brothers, in England, have also been producing cross-breds primarily adapted to the soil and climate of Britain, and some of their best breeds have been imported by the Director of Agriculture, in order to test how far they are suited to our conditions, and to what extent they are an improvement upon the already cultivated varieties. The work of the Garton Brothers has now become well-known owing to its successful results, but what is not so well known is the long years of patient toil and frequent failure which marked their earliest attempts at "the marrying together, as it were, of any variety of plant with another variety of the same species, and thus producing progeny or new breeds from the co-mingling of the plants." It was only after 20 years of patient experimenting that the results were sufficiently definite to be placed before the public in a practical shape. Our experience in the past has been that cereals fitted for a climate like that of Britain do not take kindly to our sunny south, but it cannot fail to be interesting, and possibly profitable, to test in different districts the suitability of these new breeds, and compare them in their several characteristics with those produced by Farrer, and others already acclimatized.

New Era Wheat.

Among the new breeds of Garton wheats tried here, the only one that promises well is New Era, and even that is rather late and backward, but it will be given a further trial. Its pedigree and description are as follows, but it must be remembered that its

success in Britain is no guarantee that it will do equally well under our conditions.

Pedigree.—

TALAVERA TRITICUM SPELTA — BARTWEIZEN FULTZ

(ENGLISH) (SPECIES—SOUTHERN ASIA) — (HUNGARIAN) (AMERICAN)

NEW ERA

Description.—"Early: grain medium large; color amber translucent; straw long, strong and of fine texture; ear very long, compact, and bearded.

The introduction of this new breed of wheat is a forerunner to a remarkably distinct series of other new breeds to be introduced at a later period, and marks the turning point when the British farmer will be able to produce a wheat superior in quality to the majority of foreign wheats now so largely used by our millers. The quantity and quality of gluten, produced by the New Era when grown in suitable wheat growing soils, is remarkable, and is quite equal to that of the best imported varieties. As a miller's wheat it has no equal, and will realise shillings per quarter more than any other wheat."

Abundance Oats.

Among the oats Abundance, a new breed of white oat, possesses the advantage of earliness, combined with good yielding qualities. It was introduced by the Gartons in 1892, and its pedigree is

WHITE AUGUST — WHITE SWEDISH

ABUNDANCE.

The regenerated, not the original stock, was used, and the advantage to be gained from this is accounted for by the Messrs. Garton in the following remarks:—"When new breeds of plants are raised from cross fertilized seed the tendency is, after the lapse of a few years to deteriorate, as strikingly shown in the different varieties of potatoes which succeed for a few years, then fall out of cultivation to give place to others of more recent origin. This is exactly what occurs in all other new breeds of farm plants which are produced by means of artificial fertilization. In the case of new breeds of grain this deterioration is caused by nature's system of continual in and in breeding. To arrest this deterioration and bring these new breeds back to their original productiveness, our system of plant improvement is each year applied to a number of individual florets, and from the grains thus produced a stock is raised which we term regenerated stock. Our regenerated stock of Abundance being practically eleven years younger than the original stock now generally grown, is consequently more vigorous and productive, as may be seen from tests made between the regenerated stock and the original stock by the Highland and Agricultural Society of Scotland."

Brewers Favorite Barley.

The most successful of the Garton barleys tried in the northern districts was the Brewers Favorite, and this is described as an ideal malting barley. Already in the Murray district of Victoria the finest samples are grown, and it is most important to introduce fresh types suited to the soil and climate. The pedigree and description are given by Gartons as follows:—

Pedigree.—

FAN—GOLDEN MELON.

STANDWELL—CHEVALIER. CHEVALIER.

BREWERS FAVORITE.

Description.—"Medium early. Grain intermediate in form between Chevalier and Standwell, large and very thin-skinned. Straw medium long and strong. Ear long and moderately compact.

In the production of this new breed of barley, which is intended for districts where the demand is for a very high class of brewing barley, the aim has been to retain as far as possible the fine quality of the Chevalier, at the same time giving additional strength to the straw.

The principal claims which recommend this ideal combination (as shown by the pedigree above) for universal cultivation are:—

1. From a brewer's point of view, its exceptionally fine quality of grain, resulting through the combination of the Chevalier a second time over.

2. Its great immunity from smut, a defect to which the Chevalier is very subject, and which in some seasons and districts decreases the yield very considerably.

3. The fibrous nature of the straw at the base of the ear, to which the grains are attached, thereby rendering it less liable to "neck" and shed the grain.

4. Its immense yield of large, long, plump grain, which combine in every detail the valuable malting and brewing qualities possessed by the Chevalier.

5. Its strength of straw, rendering it less liable to lodge during rough and stormy weather."

A FEW GOOD CROPS.

The wheat crops of the past season were, on the whole, so remarkably good that anyone confronted with the task of securing a photograph of the best growing crop in the State, or even in any particular district, would soon have found it necessary to abandon the work in despair, or else to make a picture of every second one. The reader must, therefore, not imagine that the illustrations accompanying this are put forward as representatives of the best the State can produce in the way of wheat crops, they are merely intended to convey some idea of what was seen in a day's drive through the Donald district.

Mr. Thos. Connellan, of Laen, last April, drilled in 37 lbs. of Purple Straw per acre, together with 37 lbs. of Florida superphosphate, and obtained the very satisfactory yield of 34 bushels per acre. This crop is seen in Fig. 1, the ears being on a level with an average man's shoulder.

One of the favorite wheats for stripping, since it stands up so well, is Dart's Imperial. Fig. 2 shows a fine crop of this variety grown by Mr. W. A. Morgan, of Witchipool. This was drilled in without manure, and yielded 32½ bushels per acre.

Mr. H. Adams, of Laen, had an excellent crop of Sullivan's Early, which was put in with a cultivator, without manure, in the middle of May, using 30 lbs. of seed to the acre. The yield was 21 bushels per acre, but it was estimated that at least another 4 bushels was shaken out by storms. (Fig. 3.)

The splendid yield of 4 tons per acre of oaten hay was obtained by Messrs. Laidlaw Bros., of Laen. Early in May 40 lbs. of Algerian oats were drilled in with 40 lbs. Florida superphosphate. Fig. 4 shows this crop standing in the stooks early in December.

FIG 1.—PURPLE STRAW—YIELD 34 BUSHELS PER ACRE

FIG. 2—DART'S IMPERIAL—YIELD 32½ BUSHELS PER ACRE

FIG 3.—SULLIVAN'S EARLY—YIELD 21 BUSHELS PER ACRE

FIG. 4.—ALGERIAN OATS—YIELD OF HAY 4 TONS PER ACRE

RERRAF—A RUST-RESISTING WHEAT.

By D. McAlpine.

Till last season Rerraf was the only variety of wheat out of the many hundreds tested by the Pathologist's Branch during the last ten or twelve years which possessed in a special degree the power of resisting rust, combined with good yielding quality and apparent suitability to local conditions. This wheat is a sport received in 1894 from Mr. Wm. Farrer, Wheat Experimentalist in New South Wales, and is derived from Blount's Lambrigg. The uniform excellence of the yields of this variety at Port Fairy, since it was first received, together with its continued and almost complete freedom from rust, when other sorts alongside were badly diseased, marked this variety as one worthy of being tested on a larger scale, and over a wider range of country. To that end it was announced early last year that small samples of the seed would be distributed to farmers free of charge, provided cost of postage was defrayed by those applying. In this way over 400 samples were sent out, and the generally favorable and often enthusiastic reports received from the growers concerning its yield and behaviour are especially gratifying.

As was only to be expected in such a large number of tests carried out in all districts, in all sorts of soils, with all kinds of manure, and in some cases with very late sowing, several failures were reported. In a few instances birds destroyed all the grain, since it was planted in the garden instead of in a corner of a wheat paddock. An odd case or two occurred in which the seed had been unfortunately sown upon a piece of land infested with the take-all fungus, so that the heads were small and thin, and the grain lean and shrivelled.

It has never at any time been claimed that Rerraf is a perfect wheat, absolutely rust-proof under all conditions. It has only been stated that wherever tried it had proved immeasureably superior in rust-resisting qualities to any variety in general or experimental cultivation sown alongside. At the same time it was confidently expected that the remarkable power to resist the destructive rust-fungus exhibited by this wheat in such moist localities as Port Fairy, Myrniong, and Leongatha, would be a fairly constant characteristic in most parts of the State. This anticipation has been more than realised, for an examination of the 159 detailed reports, so far received, shows that in 81 instances no rust was observed, in 32 other cases the rust was very slight, in 29 slight, in 2 moderate, and bad in only 4.

FARMERS' REPLIES.

Degree of Rustiness.		Promising.	Further Trial.	Not Promising.
None ..	81	57	8	16
Very Slight ..	33	19	11	3
Slight ..	30	19	8	3
Moderate ..	2	1	—	1
Bad	4	—	—	4
No Report ..	11	—	—	—
Total ..	161	96	27	27

Numerous extracts from the farmers' reports are quoted below, unfavorable as well as favorable, and the four in which the rust was stated to be bad are given in full.

Favorable Reports.

NO RUST.

Mr. Wm. Cumming, Nyah, *via* Swan Hill—

Not manured. No rust; but Queen's Jubilee very bad, 3 bags to the acre; Rerraf 6 bags. [See colored plate.]

Mr. Moses Miles, Menarpurr—

No rust on flag or straw. Purple Straw sown a month earlier was badly rusted The Rerraf was sown in a small patch in the middle of the Purple Straw, with a space of 14 inches all round, but the two varieties were touching at the top. I am certain it is rust-proof, for it could not have had a more severe test.

Mr. J. C. Maisey, Berriwillock—

No rust whatever; but self-sown Steinwedel alongside was as rusty as an old saw. Kindly inform me if you can supply a bag, and at what price.

Mr. Wm. Grossman. North Wangaratta—

No rust could be found on any portion of straw or flag. I have counted as many as 25 heads in one stool. *The heads are extra long and prolific,* straw clean, and very white.

Mr. James Liddle, Beulah—

No rust noticeable. The only doubt I have is that Rerraf will shake with heavy winds.

Mr. I. Trotman, Kurraca—

Not the slightest sign of rust on straw or flag. It has a beautiful soft, clean straw, and should make splendid hay, and chaff of the first quality. *It is the first to ripen, although the last sown,* taking only 19 weeks to mature.

Mr. J. H. Donovan, Seymour—

No rust visible. Straw a deep yellow of fine fibre; grain fully matured. The Rerraf was sown on river flats, very moist land, on which we are always afraid to sow wheat on account of rust. I put the Rerraf to a severe trial by sowing on this class of soil, and it has come out splendidly. The Velvet wheat sown alongside was very badly affected by rust.

3-colour process.

R. S. BRAIN, Govt. Printer

RERRAF.

Straw perfectly clean.

QUEEN'S JUBILEE.

Straw badly rusted.

Mr. John Arbuckle, Gre Gre—

No rust at all. If it has any fault at all it is perhaps a little soft in the straw, and does not stand up well. It ripened a fortnight earlier than Purple Straw sown alongside. The parcel I got weighed exactly 7 ozs., bag included. I threshed it out this week, and had a return of 15 lbs.

Mr. William Gleeson, Sutherland—

No rust whatever. Dart's Imperial, sown at same time, badly affected. From the half-pound sown I will get about 20 lbs.

Mr. W. Brereton, Gunbower—

No rust, but Steinwedel and Purple Straw full of rust.

Mr. H. E. Dixon, Oakvale—

No rust. Rerraf was sown in the centre of Purple Straw, which was rusty. From the pound of seed I got a yield of 33 lbs.

Mr. E. Pearce, Jeparit—

No sign of rust. I find Rerraf tends to lay down during rain and wind.

Mr. J. Hicks, Kaniva—

I did not receive the wheat till after I had finished seeding, so had to plant it alongside greenstuff, heavily manured last year with farmyard, and about 60 lbs super. The greenstuff was rotten with rust, and the Rerraf free.

Mr. M. Flannery, Rowland—

No rust visible. Purple Straw alongside very rusty.

Mr. H. Schunk, Natimuk—

No signs of rust, but Dart's Imperial and Tuscan much affected with rust. I sowed one-half on timber land and the rest on soil similar to the Wimmera plains, and it does well in both places.

Mr. Michael O'Dwyer, Tabilk—

No rust appeared. I harvested it on 16th December. It seems a good head.

Messrs. Aldridge Bros., Springhurst—

Free from rust. Sown one day later than Dart's Imperial, but ripened three weeks earlier. Two pounds of seed yielded 52 lbs.

Mr. James H. Hosking, Beulah—

No rust whatever, but Dart's Imperial sown at same time was very rusty. Rerraf is rather weak in the straw.

Mr. G. T. Glenny, Gunbower—

No rust at all. I sowed three-quarters of a cup full, and reaped 35 times as much. It did not stand the hot winds too well, and the storm coming shortly after blew it about so as to make it bad for stripping, but with a binder not a straw would be lost.

Mr. Diprose, Lorquon—

No rust. Bluey sown at the same time surrounded the Rerraf, and was very rusty. Promising; an early wheat, about the same as Steinwedel, but does not seem so liable to shell out.

Mr. J. T. Clark, Toolleen—

Rerraf is an early wheat, and sown in the month of March should give a good return. It is perfectly rust-proof.

Mr. W. J. Rutland, Jeparit North—

No rust on either flag or straw, but several kinds among the sample sown showed rust badly. *I thought it would be a bad wheat to shake, but it seemed tough to thresh.* It has one fault, it does not seem to stand up too well.

Mr. J. W. Skinner, Caniambo—

The Rerraf had no rust at all, and was sown in the middle of a paddock of Purple Straw, which was badly affected with rust on the flag.

Mr. Ebenezer Jayner, Newbridge—

No rust whatever. I have hand-threshed the wheat, and got 21 lbs. (from ½ lb.) of splendid clean wheat, which I intend to sow and give another trial. I have no doubt about the Rerraf being a rust-resister. Purple Straw sown on the same day was badly affected with rust. Rerraf is rather weak in the straw, and more liable to go down than Purple Straw, but I think if the wheat was put in with the drill with manure it would help to stiffen the straw.

Very Slightly Rusted.

Mr. James Corbett, Lillimur—

Only a few specks of rust on about half a dozen straws in the whole sample. It is a strong, healthy plant, and *the best headed wheat I have ever seen.*

Mr. C. A. Yeamans, Tennyson, *via* Prairie—

Rust very slight on the straw as well as on the flag. This season, on the light timbered land, it is the *best wheat of all*, as the other varieties, Purple Straw, Queen's Jubilee, and Turvey's Experimental are all badly affected by rust.

Mr. Thos. Brown, Colbinabbin—

I think it will be a very good wheat for here. It is earlier than Port McDonnell or Purple Straw. I cut it on 16th November, and have not yet threshed it, but think I will get about one bushel from the lb. I sowed.

Mr. W. J. Ingram, Tittybong—

Rust very slight on flag, only an odd spot, but Steinwedel all round it, sown on the same day, and with same manure, was very rusty.

Mr. R. G. Landry, Diapur—

Rust very slight, just a spot or two on the flag, but Queen's Jubilee very rusty.

Mr. G. F. Hutchings, Rupanyup—

Rust very slight on the flag only. Dart's Imperial, Purple Straw, Queen's Jubilee, Steinlee, Warland's Prolific, and Zealand Barthoud were all rusted, some very badly.

Slightly Rusted.

Mr. T. H. Leach, Youarang—

Slightly rusted on the flag I consider it a useful wheat. It is early, with a light straw, stools and heads well, and *I think would stand rough winds as regards shaking.* The grain is plump, but rather small.

Mr. H. Winkley, Koondrook—

Rust slight on flag. It is a promising wheat, on account of being early. It suits our climate. It was watered. The half-pound of seed returned half a bushel.

Mr. Gilbert Sloan, Swan Hill—

The rust did not affect the Rerraf. It filled very well. Dart's Imperial, sown at same time, was very bad with rust, some was not fit for sale. Everyone that saw it reckons it a good wheat, but it is not so good for stripping as Dart's, as it takes a lean and tangles after storms.

Messrs. Laidlaw Bros., Donald—

We are much impressed with the Rerraf, as even though sown late (last week in June) the grain is much plumper than Sullivan's Early, sown alongside.

Mr. Chris. Tobe, Dargalong—

Slightly rusty on flag only. Frampton showed a deal more rust. Good quality of grain.

Unfavorable Reports.

No Rust.

Mr. Thos. Reynolds, Euroa—

No rust; but rust showed on other wheats. Rerraf has a very poor head, and small grain. I should think it would make a good hay wheat, as it is inclined to be fine in the straw, and keeps a good colour when cut. I cut it for hay to see if it was suited for that purpose, and find it is.

Mr. S. S. Tully, Wickliffe Road—

No rust; but Frampton sown alongside shows a little. The Frampton is fully one foot higher, and promises to yield much more.

Mr. T. Rottenberg, Ulupna West—

It is not a promising wheat here. The plants grew very tall, but went down the first bad weather. [Another report from Ulupna says :—"It is very promising, as it is early and yields well."]

Mr. H. M. Raven, Campaspe—

No rust; but I do not regard it with much favour. Purple Straw drilled alongside is much the best crop.

Mr. Jas. Chisholm, Swan Hill—

No rust; but Steinwedel sown at same time had a good deal of rust. Rerraf has an open head, and a poor lean grain.

Mr. Thos. H. Clarke, Congupna—

No rust. The reason I do not like Rerraf is that it is either not true to name or else it is a very mixed wheat.

Mr. Thos. Prentice, Sea Lake—

No rust; but Steinwedel sown at same time bad with rust. Not promising.

Mr. W. S. Mackenzie, Yalca—

Quite free from rust. It is a poor yielder, and bad for shaking if thoroughly dry, being so poorly chafled.

Mr. Watson, Nannulla—

It was not rusty, but got blighted. [Take All?] It is a very poor sample of wheat, but it might do better in other situations or other years. I put it in the garden, but I think the ground might have been too rich. It seems a very early wheat, but not too good a head.

Slightly Rusty.

Mr. J. C. Greenberger, Ni Ni Well, Noorak—

Tardent's Blue, Square Head, and Purple Straw are the best up here. We want wheats which stand well up to the stripper, and the Rerraf is going down to the ground.

Mr. David Campbell, Rupanyup—

Rust on straw the same as present on other varieties, Purple Straw and Dart's Imperial. It did not stool well, and is very thin in ear, and broke down badly with wind and rain.

Badly Rusted.

Mr. A. Fraser, Timmering East—

Rust bad enough to affect the quality and yield, but was surrounded by a heavy yielding variety which promised 33 bushels, but only went 12. Rerraf is far from promising in comparison with its surroundings, the Turvey heads being 6 inches long all over the paddock, while Rerraf had straight light heads as if blighted. I got 6 lbs of shrivelled seed from it, and will try again. Not half the seed germinated. [Take-all?]

Mr. James Lawnie, Bonnepra—

Rust bad on straw and flag, and also affected the grain. Not promising. I consider it a good yielding wheat, and early, but very bad for shaking.

Mr. John Groves, Tatura—

Land manured for several years with cow-yard manure. Bad with rust on flag and straw. Sowed Purple Straw next day, not much rust on it. I could not say what the wheat was like, as the sparrows ate every grain, then you could see the blighted heads with straw about four feet long. [Take-all?] I suppose it was Rerraf I got, all I know is that it was from the Government, as the bag was branded.

Mr. C. Fraser, Byaduk—

Rust bad on both straw and flag. White Tuscan was worse than Rerraf Sown very late, July 12th. Not a promising wheat. The last winter was the worst we ever had for wet, the wheat did not get a fair trial, but I think the grain is very small.

Milling Quality of Rerraf.

A sample of this wheat, grown by Mr. Wm. Cumming of Nyah and yielding at the rate of 24 bushels per acre, was forwarded to the Department of Agriculture, New South Wales in order to have its milling qualities tested. Mr. F. B. Guthrie, F.C.S., Analytical Chemist to the Department has kindly furnished the following report:—

Appearance of grain:—Translucent, small, hard, plump.
Weight per bushel (lbs per bushel):—63·8.
Ease of milling:—Fair to mill.
Percentage of mill products:—Flour, 70·3; Pollard, 16·4; Bran, 13·3.
Nature of flour:—Colour of flour:—Excellent, good surface.
Strength of flour (in quarts per sack of 200 lbs.):—50.
Percentage of dry gluten:—10·87.

NOTES.

Bran and Pollard both clean.
Semolina, slight yellow colour and gritty.
Break-flour, 24·5 per cent.

This is a good milling wheat, yielding fairly readily a good proportion of flour. Flour of first rate colour, and of fair strength, and with a good proportion of gluten. The colour of this flour is much better than that of the same variety previously examined.

Conclusions.

From a perusal of the foregoing reports it will be seen that two objections are urged against Rerraf, and neither of these have reference to its powers of rust-resistance. These two objections are weakness of straw and consequent inability to stand rough weather, and liability to shake. As for the latter it seems to be met, to some extent at least, in the report of Mr. J. Rutland, of Jeparit North, who says :—"I thought it would be a bad wheat to shake, but it seemed tough to thresh." South Australian farmers too have expressed an opinion similar to Mr. Rutland's.

There seems no doubt but that in this year of heavy growth the straw proved a bit weak, and a certain proportion was laid by storms. The position at present is that Rerraf is the only wheat which the Pathologist's Branch can recommend for general sowing as rust-resistant. Many varieties are being tested, and it is hoped that other and better all-round wheats, but equally rust-resistant will soon be available for distribution.

The Record Yield.

Since the previous portion of this article was put in type, many very favorable reports have been received. The following is given because it records the highest yield mentioned by those farmers who have been able to complete the threshing.

Mr. Geo. Blurton, Linton.

> No rust at all. Frampton showed a lot of rust. I consider it a first-class wheat, either for hay or grain. The pound of seed I put in yielded 61 lbs., being a very clean, plump and bright sample of heavy shotty grain. The straw grew to 5 feet in height. Straw very fine and inclined to go down. Compared with other wheats put in at the same period, Rerraf matured fully five weeks earlier.
>
> I consider it a very fine wheat, and when more thoroughly known should become a very popular addition to our Victorian wheats.

EXPERIMENTS WITH GRASSES & FODDER PLANTS AT LEONGATHA IN 1902-3.

By J. W. King.

In order to ascertain the suitability of this portion of South Gippsland for the growth of the various grasses, etc., catalogued by the leading seedsmen of the State, a piece of land was dug and laid out in beds twelve feet long by eight feet in width, and the seed lightly raked in from May 25 to June 24, 1902. In all 35 plots were prepared and sown, and one planted, with the following varieties:—

Crimson Clover (*Trifolium incarnatum*), Alsyke Clover (*Trifolium hybridum*), Giant Spurry (*Spergula maxima*), Sweet-scented Vernal (*Anthoxanthum odoratum*), Birdsfoot Trefoil (*Lotus corniculatus*), Sheep's Burnet (*Poterium sanguisorba*), Meadow Fescue (*Festuca pratensis*), Tall Fescue (*Festuca elatior*), Rough-stalked Meadow Grass (*Poa trivialis*), Meadow Foxtail (*Alopecurus pratensis*), Crested Dogstail (*Cynosurus cristatus*), Timothy (*Phleum pratense*), Creeping Bent (*Agrostis stolonifera*), Italian Rye Grass (*Lolium Italicum*), Perennial Rye Grass (*Lolium perenne*), Cocksfoot (*Dactylis glomerata*), Prairie (*Bromus unioloides*), Golden Crown (*Paspalum dilatatum*), Kentucky Blue Grass (*Poa pratensis*), Hungarian Forage Grass (*Bromus inermis*), Egyptian Millet (*Penicillaria spicata*), Japanese Millet (*Panicum crus-galli major*), Red Fescue (*Festuca rubra*), Narrow-leaved Fescue (*Festuca ovina tennifolia*), Sheep's Fescue (*Festuca ovina*), Hard Fescue (*Festuca duriuscula*), Evergreen Meadow Grass (*Arrhenatherum avenaceum*), Bokhara or Giant Clover (*Melilotus leucantha*), Sainfoin (*Hedysarum onobrychis*), Sulla (*Hedysarum coronarium*), Yellow Oat Grass (*Avena flavescens*), Kangaroo Grass, (*Anthisthiria australis*), Guinea Grass (*Panicum maximum*), and Chewing's Fescue (*Festuca duriuscula var.*)

In addition to the above, the following was sown on October 15, 1902:—Rhodes Grass (*Chloris Abyssinica*).

The above is a very comprehensive list, embracing as it does most of the favourite grasses and fodder plants grown in Victoria. As to the land, upon which all were tried, it is a poor buck-shot soil and sets very hard in summer. The plots were carefully hand-weeded, and with the experience gained, I would urge that in all future experiments of a like nature the seed-beds should be not wider than four feet, so that they may be kept clean by a man standing on the path and reaching over to pull the weeds, instead of treading on them, as had to be done in this instance. In a district like this, no matter what care be exercised, much injury is done to the young plants by tramping or kneeling on them whilst the ground is soft; and unless one takes advantage of the few and far-between

fine days of winter, the weeds strongly assert themselves, to the almost irreparable injury of the delicate seedlings.

Starting with Clovers, the Scarlet variety, of which two plots were sown, was a complete failure, scarcely a seed germinating. This, perhaps, may be attributed either to early sowing or faulty seed. Alsyke came up strongly and did well, proving itself a valuable plant, and standing the dry spell of last summer splendidly. It would be difficult to surpass this clover in this locality. The Birdsfoot Trefoil gave a great body of feed, but requires a richer soil. The Bokhara Clover was probably on the poorest patch, and did fairly well. Sainfoin was not a success; but Sheep's Burnet has done well. It evidently suits the district, and would give an enormous quantity of sheep-feed per acre. Sulla makes a vigorous growth, but I fancy a warmer climate and rich alluvial land would suit it better. Under more favourable conditions it should prove well worthy the attention of our farmers in the northern areas. The Millets, sown in June, were destroyed by the first frost; and one plot contained Guinea Grass—transplanted in June—which also perished. A bed of this strong-growing grass, transplanted in 1901, gave magnificent results during the following summer and autumn, but died out after the first frosts. Those well-known grasses, Cocksfoot and Prairie, were a success; but Timothy, which is reported to behave well in other portions of the district, did not come up to expectations. The Hungarian Forage Grass was a partial failure from seed—the plants coming on very slowly and unevenly—although some roots transplanted last winter have succeeded better. Still it does not seem to flourish under conditions obtaining here. The Kentucky Blue Grass is another unprofitable variety on this soil—it would be better adapted for lawns than for the purposes of the grazier. The Golden Crown *(Paspalum dilatatum)* is, *par excellence,* the grass for our creek and river flats and gullies; while there can be no doubt that it is far ahead of any other for the poverty-stricken buck-shot areas about here. In the garden, where over 20,000 plants were dibbled in during February and March, 1902, a heavy crop was cut last summer, and now the dense, luxuriant mass of succulent feed, over five feet high, is being mowed and turned into ensilage. It may here be remarked that eleven acres of our poorest land were planted in the spring and summer, 1902-03, and are a picture. It would be hard indeed to find a finer field of grass. Farmers having hungry patches on their holdings might do very much worse than sow down with this splendid grass, always being careful that they obtain hand-gathered and thoroughly ripe seed. August is the best month in which to sow, and spring and early summer to plant, although last autumn we put out some 54,000 plants, which struck very successfully with scarcely a miss, and have come on well.

Among the other grasses the various Fescues are deserving of a place on every farm in this portion of Victoria. The Tall Fescue is undoubtedly the champion of this class, enduring both the drought of summer and cold of winter splendidly. Standing between four

and five feet high, it gives a great crop of soft food eminently suitable for cattle, and it is a grass that cannot be too highly recommended. Meadow Fescue is also good both for sheep and cattle; whilst Chewing's Fescue seems an ideal sheep pasturage, its dense, soft, easily digestible foliage proclaiming it one of the best. The other Fescues are well worth notice, as they thrive on very poor country and give a nice sole of grass.

Chloris Abyssinica promises to become a favourite grass. Although not sown until October 15, 1902, yet it came on rapidly, and in early autumn had attained a height of four feet and was a close mass of fodder. Growing easily from seed it also possesses the advantage of spreading over the ground and rooting on the surface at every joint, so that it can easily be transplanted. It stood both summer and winter well, and should have a trial in various portions of the State, for it certainly, so far, gives promise of becoming a valuable addition to our list of artificial grasses.

The Kangaroo Grass sown in 1902 failed to germinate, but the seed, carefully saved last year and sown September 21, came up evenly and looks well. Many people who have endeavoured to raise this fine indigenous grass have been unsuccessful, simply because they did not take the precaution to secure ripe seed; but, given good seed, it is as easy to grow as any other, and it would be simple enough to cultivate the plants in such a manner that the greater portion of the seed could be easily saved.

As to the other grasses enumerated, it may be stated that after very careful trials they do not seem to have shown their adaptability to our soil and climatic conditions.

PASTURE DEFICIENCIES.

By J. E. Batchelor (Inspector of Stock).

Relation of the Soil to Stock.

From time to time reports reach this office of ailments affecting our flocks and herds which on being investigated prove to be due to soil wants, in consequence of which the pasture grown upon them is either lacking in certain constituents or they are present in such small quantities as to be almost valueless, the result being that animals constantly grazed on such lands in the course of a few years become run down in constitution. From debilitated parents it is hardly fair to assume that stock being reared under similar conditions will become hardy. It is often stated that in old times we had none of this trouble, and the reason is not far to seek. When our lands were first settled they were decked with feed in some districts perhaps but sparsely, and what little had grown upon the land from time immemorial had not been eaten off, but after ripening had withered off and gone back to the earth again, thus returning to the soil what had been taken from it. With settlement the case was altered, and although the timber was ringed, and the quantity of herbage grown thereby increased and sweetened, all this had been done at the expense of the soil, as nothing had been returned. Agriculturists found also that the continual cultivation of land temporarily exhausted it, and even after fallowing, while the crop of straw gave promise of heavy yields, they were disappointed very often in finding the yields so far below their expectations and the grain itself thick in the bran, in milling phraseology "branny." Overtaxing the land had robbed it of its phosphates, in consequence of which the quality and quantity of grain garnered was not up to expectations. This land was then spelled for a time, and more virgin soil broken up. In the meantime stock were allowed to nibble off the weeds and rubbish growing on land already impoverished, under the impression that they might assist in restoring to the soil some of its former vigour, entirely forgetting that the stock could not return to the land more than they received from it. True, on some cultivation paddocks thus laid down a plentiful growth of wild oats, sorrel, wire-weed, and other herbage sprang up, and the animals feeding on such lands were enabled to fill themselves, yet they did not thrive satisfactorily, this more especially so in the case of young cattle or milch cows. While there seemed to the casual observer an abundance of feed on our pastures, the cattle grazing on them in the spring of the year ravenously hunt after bones; this is because of a want in the soil, perhaps due in the first instance to only a scant supply, which has been exhausted either by cultivation or overstocking, or both. Some pastures are but poorly supplied with phosphates, and when the timber growing upon them has been ringed, and the math thickened, and afterwards heavily stocked,

these soon exhibit by the animals grazing on them their specific wants, phosphates, chloride of sodium (salt), iron, and potash. Stock derive the mineral constituents of their bones, flesh, blood, milk, and wool from the grasses upon which they feed, and these in turn must come from the land. From the soil, through the medium of its grasses, the animal takes up the mineral matters and nitrogen which go to build its structure and products, such as milk or wool. Gilbert and Lawes, names well known throughout the English speaking world in connection with their famous Rothamsted experiments, assert that a bullock of a thousand pounds live weight contains fifty pounds of mineral matter, this latter amount divided by the age of the animal will give the average annual amount taken up from the land. Again, these same experimenters (as quoted by Ralph W. Emmerson Macivor, the agricultural chemist whom the late Sir W. Clarke, Bart., brought to this State some years ago) state:—"The amount of ash present in average normal country milk is ·7 per cent., so that a cow yielding 400 gallons of milk per annum will in four years' time impoverish the pasture upon which it feeds to the extent of over 115 lbs. of mineral substances."

Turning to wool, very definite data are obtainable on the amount of potash derived from the land by the sheep. This substance, after circulating in the blood, is excreted from the skin with the sweat. Chevreul says of this potash compound that raw merino wool contains 33 per cent., but the commoner varieties of wool contain on an average 14 per cent. It is to be noted, in passing, that young growing animals assimilate phosphates to form bone, and nitrogenous matters to produce muscle and blood. Similarly also, cows in calf, as in addition to what is required for their own sustenance, they have further to nourish their fœtus. Having touched thus briefly on the mineral matter required to build up the animal's structure, the attention of dairymen should be directed especially to the lack of provision made by them to assist in maintaining the vigour of their young stock from the time they are able to pick up a little grass for themselves until they are to be sold as stores (if steers) or brought into the dairy herd as milkers. Instead of being turned out on a bare road, or into some equally bare paddock, they should have nourishing food, for the cost of which they will well repay their owner, for whatever purpose he intends them, because, if they are sustained in their early years, they will in addition to having more value, if for sale, or if intended to be kept, their systems will be better able to withstand hardship. The necessity of the presence of a liberal supply of mineral constituents having been shown, some of the troubles incidental to stock where these properties are lacking in the food supply in normal quantities will be pointed out.

Rickets—Cripples.

These two forms of disease may be traced distinctly to lack of phosphates in the soil upon which the animals have been feeding, inducing faulty development and softening of the bones, which, while

presenting normal appearances, are lacking at the same time in phosphates of lime and other compounds which serve to strengthen and nourish the ossein, which goes to develop the skeleton of the animal. To remedy this deficiency in the soil, dairymen have given bone-meal to their stock, and while the practice is highly to be commended, the greatest caution is requisite in selecting the meal, as several outbreaks of anthrax have within the past two years been traced to the use of Indian bone-meal. Heavy losses have resulted from its use, whether supplied directly to the stock as an article of diet, or with fodder grown on the land which has been treated with bone-meal. When this condition exists in stock it is much better to add crushed oats or bran to their food, or phosphate of lime. This last costs very little, and may be given in 4 drachm doses combined with sulphate of iron. It has been brought under my notice that stock when first turned upon stubble lands which have been manured with superphosphate, care little for herbage growing thereon, but after a few days the dislike appears to pass away and they thrive well, much better than they do on adjoining fields which have not been so treated.

Impaction.

Very many cases of impaction and injuries to the stomach and its pouches in ruminants bear evidence to the fact that want of salt and iron in the pasturage has induced lack of tone in the stomach, and the frenzied desire on the part of the animal to supply this want has been the cause of its death. In the mountainous districts of the State, stock in their quest for salt often discover narrow patches on the banks of creeks or gullies having a salty flavour, which they lick with avidity, often becoming entombed and crushed by the falling down of the roofs of the tunnels they have made in search of salt. Post mortem examinations of stock in such localities always reveal the presence of large numbers of worms in the stomach, yet when cattle are taken from these localities to where salt and iron are plentiful, they fatten rapidly, and on autopsy no trace of their former tormentors is found. Again, in marshy, wet, and low-lying lands fluke is often very pronounced, and salt with iron placed in troughs where the stock can have ready access to it, will invariably be found to assist the animal's constitution against these attacks. Says Bunge in reference to sodium and potassium salts:—"Owing to the poorness of vegetable food in sodium salts, the administration of common salt with the food of herbivora is a necessity—(F. Smith). And again, in spite of the many inorganic salts found in the food, one only, viz., sodium chloride, is taken by the human subject in addition to that already existing in the food. The explanation of the desire shown by herbivora for common salt lies in the large amount of potassium consumed in their diet, the effect of potassium salts being to withdraw sodium salts from the system. Iron as supplied by the food is organic, and the hæmoglobin of the blood is formed from the complex organic compounds of iron which are produced by the vital processes of the plant—(F. Smith)." While not asserting there would be no cases of

impaction or stomachic troubles in our stock with due care and attention to the details previously outlined, it is certain that if more care were bestowed by stock-owners in assisting their stock to digest their food properly, by placing within easy access liberal supplies of salt and iron, the amount of losses from this source, even in our driest districts, would be reduced by 75 per cent. That some assistance to digestion is necessary in localities where the only water the stock can obtain is to be got from dams and waterholes rendered unwholesome by the excreta of stock and the debris washed from the surrounding lands, is a fact which none will deny, and when to this is added the dry fibrous pasture, little wonder it is the stock become impacted.

POTATO DEVELOPMENT BY FARMERS AND GARDENERS.

By W. J. Malden.

The rapid development of potatoes from a small stock is of special interest now, because during the past two years farmers have discovered that, provided they can get a small stock of a new variety possessing sufficient merit, they have at their command the means of making a larger return on a given capital than has hitherto been regarded as possible. The large sums of money made by developing the Northern Star potatoes are certainly unprecedented in the annals of farming. Moreover, those who have participated in this profitable work of development have rendered a service to the potato-growing community, as it has hastened the period when a great disease-resisting variety can be obtainable by the general grower. It will be three or four more years before the price of this variety will fall low enough to be sold for culinary purposes, but it would have been much longer had a special system of development not been adopted. There are 1,200,000 acres of potatoes grown in the United Kingdom—mostly with varieties which readily succumb to disease, and therefore giving far less profit than if they were sound. Anything, therefore, which conduces to the more rapid development of disease-resisting varieties must be for the good of the grower, and also for the consumer. The strong disease-resisting powers of the Northern Star have been clearly demonstrated in all parts of the country during the past two years, and the best proof of the regard in which this variety is held is obtained from the fact that all the largest growers have recognised the necessity of growing it. The large amount of disease in the country has, of course, greatly emphasised the necessity for getting up a stock of new varieties which possess disease-resisting properties in a marked degree. There is little doubt that in the future, when a new variety possessing very special merit is brought forward, every effort will be made to develop it rapidly; and in this article an account is given of methods which can be adopted to hasten its development.

The experiments which have been carried out for nearly a century on cut *versus* uncut sets have generally shown that there is a stronger crop from uncut sets; and the popular mind has accepted this view, which within certain limits is correct. A whole potato is encased in a skin which retains moisture; moreover, many insects, such as wireworms, eelworms, and other scavenging insects do not so readily attack an unwounded set as one which has been cut, or is in any way decaying. A cut set is at once acted upon by surrounding conditions, and decay immediately sets up about the cut portion. Where, therefore, it is planted under conditions where it has to make a struggle

for existence, it is not so favorably placed as is one which has no wound. When a tuber is cut so as to provide a large number of sets, the sets are small; therefore, so far as possible, the struggle to establish a plant must be facilitated by all reasonable means. The experience of the last few years shows that this may be done on a large scale at a moderate cost. When in a previous article we urged that it was not a matter of overwhelming difficulty to cut each eye from a potato, and pot it separately so so to give it favorable opportunities to produce a plant, there were those who expressed the contrary view, and maintained that it was impossible for it to be done except on a limited scale. To confirm our expressed views we last spring had 50,000 eyes cut from 14 cwt. of tubers, and planted in as many pots. The plants grew with a very small percentage of misses, and at the present time we have nearly eight acres growing vigorously in the field. Few who have seen the crops would previously have believed that the fine plants now growing could have been raised from other than a whole set of ordinary seed size.

As a means of placing this work before others so that they may practise it, we give a detailed description of our methods at the Manor Farm, Ham. Cutting out each eye and potting was commenced at the beginning of April, though in ordinary circumstances it might be begun earlier. Two reasons led to this—first, the eyes were backward; and second, it was thought desirable not to be too early for fear of spring frosts after they were transplanted into the field. No large buildings or sheds were available, so an outdoor camp had to be devised. A piece of ground was levelled and the pots were placed in ranges about ten pots wide with narrow pathways between. Some loose mould was spread over the ground, and 3-inch pots were set in this as closely as possible to one another. The north side and the ends were made of walls of straw about 4 feet 6 inches high, but on the south side only about 2 feet 6 inches, so as to admit sun. A range of 4-inch by 3-inch stakes was set up the middle, standing about 3 feet above ground. Along this was stretched a stout wire. Cross strands of wire were run from side to side over the middle row of piles, and these were attached at either side to a row of piles about 15 inches high, so that when the covers were put on they had a good shoot to clear the rainfall. The sheets were 12 feet wide, and were fitted with rings so that they were easy to furl. In sunny weather it is well to admit all possible sunshine, and a ready means of furling and covering is desirable.

Having put down the pots, into which small pieces of crocks were placed, and set up the shelter, cutting was commenced. At the same time earth was finely sifted and placed in the pots, after being mixed with a small quantity of super-phosphate of lime. As fast as the sets were cut they were sprinkled with slaked lime, and straightway potted. With such small sets it is advisable to place the eye upwards. The pots were nearly filled, and the earth very lightly pressed; a hole was opened with a knife and the set put in; subsequently a little loose mould was sprinkled over to fill the pots.

Beyond regulating the cover night and morning, little attention is needed beyond an occasional light watering, just sufficient to maintain a slight moisture, which is largely regulated by the power of the sun.

The planting out was done as the plants became big enough. A good tilth was prepared in an ordinary field, and lines were marked out by drill coulters set 32 inches apart. The plants were placed about 30 inches from one another in the rows. In carting the pots to the field, racks made on light frames, with divisions just narrow enough to prevent the pots from slipping through, were used, and each rack carried 100 pots. These are convenient also for carrying the pots in the field to lay out for planting. The racks were long enough to reach across the carts, one layer being placed in the bottom, and another across the raves, so that it was easy to take 1,000 plants to the field at once. After the plants were laid out, the planters, each with a garden trowel, wrenched out a hole in the loose earth, and placed the plant with all the soil from the pot adhering (being well held together by the roots) into the hole. Planting was then completed, and the subsequent cultivation did not differ from ordinary practice. The value of growing in pots was well illustrated, for practically every one grew, while in a small piece not potted there was a considerable percentage of misses. So robust was the growth from these plants raised from single eyes that the large amount of room allowed proved to be none too great for their development.

By taking out each eye separately it is not difficult, with careful management, to raise 100 lb. of potatoes from 1 lb. of tubers. This, however, is not by any means the limit to which development may be extended. The eye of a potato generally contains two to four shoots, and it is possible to make use of all of these. If a potato is sprouted as in the ordinary course of "boxing," and the shoots are allowed to grow three or four inches in length, these may be pulled off, and if carefully planted will produce plants.

The development of a large stock of potatoes from a single tuber can therefore be quickly carried out, and it will tend greatly to growers' benefit when they realise how little expense need be incurred in getting new stocks, even though the cost for the initial few pounds at first sight appears to be great. The most expensive action on the part of the grower is the growing of varieties which have been cultivated so long as to have lost their original vigour, and have become subject to disease. The two last years have very strongly proved this.—(*Journal of Board of Agriculture*, England, December, 1903.)

GRADING RABBITS FOR EXPORT.

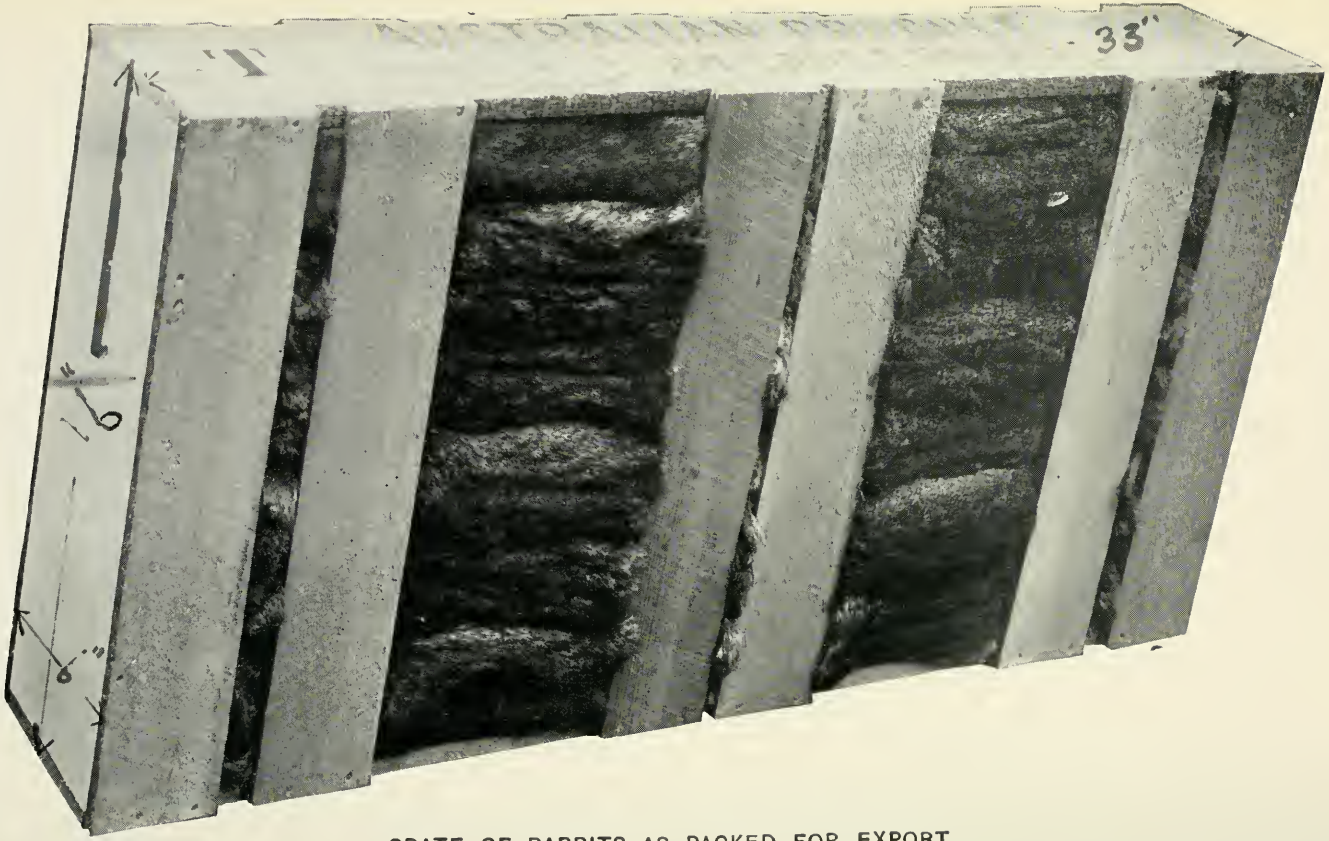
By R. Crowe.

Practically the whole of the rabbits exported from Victoria are packed in crates bearing the Government stamp "Approved for Export." The conditions attaching to the use of this brand are that all Freezing Works requiring it shall undertake to submit rabbits packed there for shipment to a grader appointed by the Department, and only those passed by him and stamped to be exported. The rabbits are classified into *two* grades *only*, and each grade is divided into three sizes. The fattest and best conditioned rabbits are packed as "24 Large Rabbits," each 2½ lbs. and over in weight; "24 Young Rabbits," each over 2 lbs. in weight, or "24 Small Rabbits," each 1½ lbs. and over in weight. The outside measurement of the crates is "Large," 33in. x 16in. x 6in. or 1·83 cubic feet, and 21 of them go to the ton measurement; "Young," 31in. x 15in. x 5½in. or 1·48 cubic feet and running 26 to the ton measurement; and "Small," 30in. x 15in. x 5in. containing 1·33 cubic feet and running 30 to the ton. The brands of those three sizes of crates holding first grade rabbits are *black* in color, and the Government stamp includes an index to the month and year in which they were packed, and the name of the grader.

Fig. 1 is a representation of the stamp without index :—

Fig. 1.

The second grade rabbits are not so prime in condition as those of the first grade, and the different sizes are designated as "24 Rabbits 2nd grade, Size 1," over 60 lbs. net; "24 Rabbits, 2nd grade, Size 2," over 48 lbs. net; "24 Rabbits, 2nd grade, Size 3," over 36 lbs. net. The crates containing those rabbits are stamped as in Fig. 2.



CRATE OF RABBITS AS PACKED FOR EXPORT.

Fig. 2.

The measurements of second grade crates correspond with the first, and all brands on crates containing second grade rabbits are *red* in color. Crates in which rabbits are packed for export carry the full name, in letters of not less than one inch in size, of the Freezing Works where such rabbits were graded and frozen.

When a grader is required by a Freezing Works, written application has to be made for his services to the officer in charge of the Government Cool Stores, and a deposit of £35 per quarter must be paid in advance to the Secretary for Agriculture to meet the salary of grader, together with the fare to and from the place where his services are required. This advance is to be supplemented if necessary, and any portion of the sum not required will be refunded. To cover expenses while engaged away from their homes, graders who are married are allowed two and a half hours extra time daily. Each grader is supplied with a time book, which has to be certified to by the proprietor or manager of Freezing Works each day.

The grader has to keep a book shewing the number of rabbits graded daily, together with particulars of the number packed as "Large," "Young," "Small," "Size 1," "Size 2," "Size 3," "Rejects" as unsuitable for export, and of those "Condemned" as unwholesome, and supply such information weekly, as well as details of shipments made, to the officer in charge of the Government Cool Stores.

The officer in charge of the Government Cool Stores has the right at any time to exchange or remove the grader, and changes are made occasionally.

It will be seen from the foregoing that each Freezing Works is saddled with responsibility, as crates treated there bear the name of the works in full, and the grader is also made responsible for crates on which he places the Government stamp, as such stamp bears an index to his name. In addition, the work of all graders is checked by Mr. Hart, from time to time, both at the works and ship's side. The result is that no complaints have been received regarding the quality of Victorian rabbits bearing the Government brand for about

two years, during which period 13,550,614 rabbits have passed through the Department's graders' hands, worth nearly half a million pounds sterling.

Since the Government adopted this means of enabling the wholesome flesh of the rabbit to be utilised, whilst assisting in exterminating the pest, 34,163,410 rabbits have been frozen and exported. This one section of the rabbit trade alone is accountable for bringing into the country upwards of one million pounds.

Last year the rabbits submitted to graders gave the following average proportion :—"Large," 42·9 per cent.; "Young," 13·2 per cent.; "Small," 2·3 per cent.; "Size 1," 9·3 per cent.; "Size 2," 4·1 per cent.; "Size 3," 2·6 per cent.; "Skinners," 0·42 per cent.; and "Rejects," including "Condemns," 25·1 per cent. These results differ from day to day according to weather conditions and care received during transit.

Prior to the commencement of last season the Department did not put up the second grade of rabbits in the fur, as all such were skinned and packed in crates as "Skinners."

Certain shippers prefer at times to skin the second grade rabbits and ship them as formerly.

Exporters of course employ their own trade marks and brands, but the general terms before mentioned are used in all Freezing Works, and it does not matter whether the rabbits have been packed by Jones, Brown, or Green, business is done on the two grades and sizes of each. The London or Liverpool rabbit importer cables for quotations for "Large" or "Young," or "Size 1," etc., as the case may be, with the absolute certainty of obtaining the article he requires.

THE ORCHARD.

By Jas. Lang.

March will be a busy month for the orchardist, gathering and marketing the fruit occupying most of the time. The present summer will long be remembered for the copious rains which have fallen, and the low temperature which has prevailed right through, so that the consumption of soft fruits has been very much restricted, with unremunerative prices to growers. In summer fruits the production has now overtaken the local demand, and other outlets will have to be secured in the future to render the business a profitable one, either by the export of pulp or drying, as the present condition of the oversea carriage of soft fruit in the cool chambers of our steamers is not very encouraging. There is no doubt, however, that with improvement in the method of cooling the fruit chambers of the ships, a large export trade will spring up in soft fruits.

Manuring.

The manuring of orchards is a subject which has not received the attention that its importance demands. Trees cannot go on for all time bearing heavy crops of fruit without the soil becoming exhausted, and the older our orchards grow the more necessary does it become that the best methods of prolonging and increasing the productiveness of the trees should be carried out, which can best be done by applying artificial or stable manure.

Green manuring is also practised with good results by many of our leading orchardists. Plough the ground as soon as possible after the fruit has all been gathered in, and sow with dun peas at the rate of two bushels per acre. Apply one cwt. of superphosphate with the peas, this will give them a good start and will also greatly benefit the trees. In spring time, about the early part of September, the peas will be fit to plough in. First roll them with a heavy roller the way the plough runs, also fit the plough with a revolving coulter when the peas can be turned in without much trouble. Before ploughing the peas in, 2 cwt. of superphosphate and 3 cwt. of muriate of potash per acre should be applied. This forms a very complete manure, the peas supplying the nitrogen and humus, the superphosphate the phosphoric acid, and with the potash the trees will be furnished with all that they require. Farmyard manure should also be applied where sufficient quantity is available. A good dressing of virgin soil, wood ashes, or any kind of litter is also of great advantage where it can be obtained.

Fruit Export.

In gathering apples and pears for export, it is advisable to gather them in the early morning when the fruit is cool. Advantage

can always be taken of changes in the weather to select a cool morning to gather the fruit, on no account should fruit be gathered on a hot afternoon, as the fruit then never thoroughly cools down before being packed. Fruit packed in a heated state never carries well, and is generally landed in bad order.

There is a good deal to be said in favor of putting the fruit in a cool chamber before being packed, but so far it has not carried well, owing to being placed in the ship's cool chamber with uncooled fruit. Where the whole of the fruit in the ship's cool chamber has been treated in this way it is very satisfactory, but as in the case of our mail boats, the great bulk of the fruit in the cool chamber is from Tasmania, which has been packed in the orchard, and is, therefore, of much higher temperature, the case is different. This is because the cold air is driven in at a very low temperature in order to cool the bulk of the fruit, consquently the cooled fruit placed in the same chamber suffers, and is never landed in such good condition as the uncooled portion of the cargo. The remedy lies in the whole of the fruit intended for the one chamber being cooled down to the same temperature before being placed on board.

During the past two or three years some of our shippers have had their consignments cooled prior to shipment, but these consignments have not turned out in such good condition as was expected, and, according to the sale catalogues, only realised moderate prices.

THE VEGETABLE GARDEN.

By Thos. W. Pockett.

The chief work in this department for March and April will be thinning out growing crops, keeping the land free from weeds, and where necessary trenching, draining, or otherwise preparing land that may be required for planting new beds of asparagus, rhubarb, seakale, or other vegetables that require rich, deep soil. Continue to plant out cabbage of the winter kinds, also cauliflower, using land that has been well enriched with manure and not likely to be sour in winter.

Make occasional sowings of turnip and prickly spinach. Kohl rabi may be sown and planted out like cabbages. Seed should also be sown of lettuce and endive, which may be thinned out or transplanted. Parsley seed should now be sown for winter use. When onions are required for transplanting in June the seed should be sown early in April; if sown before, the plants are liable to run to seed.

Draining.

The degree of success attained is largely due to the drainage, either natural or artificial. Most soils are benefited by artificial drains. The nature of the soil determines the kind of drains and the distance they should be apart. A retentive soil requires a drain, say, 15 feet apart; a sandy loam, resting on a clay subsoil, say, 30 feet apart; while a deep sand may not require draining, unless where it is necessary to cut off the soakage, which is generally determined by the depth of the sand above the hard layer or subsoil. On sandy soil this is very irregular, and although fewer drains are required there are more difficulties to encounter. Drains should also have a greater fall on sandy soil on account of the minute particles of sand that gradually find their way into the drains.

Material for Drains.—Perhaps the best and easiest way to make drains is by using agricultural pipes, since there is less excavating, and the only tools generally used are the draining tool and scoop.

Depth of Drains.—The depth should be 9 inches or 1 foot below the depth that the ground is likely to be trenched or worked.

Covering.—In stiff soil the covering over the pipes may be straw, brushwood, or similar material, then turfy soil, or something that will remain porous and allow the surplus water to percolate into the pipes. In sandy soil great care must be taken in laying the straw or fine brushwood over the pipes, and if the subsoil is of a sandy nature something must be then placed carefully over in the shape of turf parings, and if a few inches of crumbly clay can be then put over the turf the drainage will be complete.

Outlet and Fall.—A good outlet is necessary, and drains should, as far as possible, be placed at an angle: viz., supposing the fall in the land be from north to south, the drains should then be run north-east or north-west. A fall of 1 in 50, or 1 in 100, is sufficient for drains properly laid.

FLOWER GARDEN AND SHRUBBERIES.

Owing to the exceptionally wet season many trees and shrubs have made excessive growth, and as there is not likely to be any very hot weather this autumn, a judicious thinning during March or April would be better than waiting until the winter, for when thinning can be done early, and the plants still vigorous, any superfluous growths are practically not missed. The planting of evergreen trees and shrubs may be done earlier, and especially plants put out of pots; in fact all work should be arranged, as far as possible, to suit the season.

Plants that are liable to get mildew, such as roses and chrysanthemums, will certainly have more than usual, and it is much better to use sulphur, or other preventatives, to check it in time, than to wait until the plants are seriously injured and the chances of good blooms gone.

TREATMENT OF BUNT OF WHEAT AND SMUT OF BARLEY.

By D. McAlpine.

These are two very prevalent fungus diseases of cereals, and cause considerable loss when no precautions are taken to prevent them.

Bunt *(Tilletia)*, or stinking smut as it is usually called, is easily recognized, both from the appearance of the grain and the ear. The grain is filled with a black mass of fungus spores which emit an odour not unlike stinking fish, especially when rubbed, and the skin is of a dark unhealthy green colour. The ears affected remain longer green than healthy ears, and being lighter than the sound ones, do not bend over, but remain upright.

Smut *(Ustilago)* is also characterized by the grain being filled with a mass of black dusty spores, which are very conspicuous, and usually the loose spores are scattered by the wind. In barley, however, there is the naked and covered smut, and it was the latter variety dealt with in these experiments.

In order to understand the treatment, it is necessary to know that infection can only take place when the plant is young and tender, and the fungus filaments grow inside, keeping pace with the growing plant, until the young seeds are formed, and then the fungus uses all the nourishment stored up there for the production of its reproductive bodies or spores. These spores are so light, and so numerous, that in harvesting operations they readily become attached to the healthy grain, and if the conditions are favourable, infect the young plant when germination occurs. It is evident that prevention must be resorted to, and the seed to be sown is treated in order to destroy or prevent the germination of the spores. The most commonly used steep or pickle is that of bluestone or sulphate of copper, but corrosive sublimate and formalin have also been found efficacious.

Stinking Smut of Wheat.

In order to test the relative merits of bluestone and formalin for the stinking smut of wheat, experiments were carried out at Port Fairy with both. Seed wheat was thoroughly infected with the spores of stinking smut, and divided into three portions, one being treated with bluestone solution, another with formalin, and a third left untreated. Large patches were sown in each case, and carefully examined by Mr. Goldie and myself towards the end of December.

Bluestone was used at the rate of 1 lb. in 5 gallons of water, and formalin at the rate of 1 lb. in 40 gallons of water.

The method adopted was to spread out the seed on a wooden floor and sprinkle the solution over it, turning the grain over and over, either by shovelling or raking, so that all the grains became thoroughly wetted. The seed was then spread out to dry, and it was

found that if left in a thin layer over night it was ready for sowing in the morning.

Instead of sprinkling, dipping may be resorted to. A bushel or so of seed is placed in a bag and dipped in the solution, taking care that all the grains are thoroughly wetted by shaking the bag and plunging it in and out. In the case of bluestone only a minute or two is necessary for the dipping process, on account of its corrosive action, but in the case of formalin five minutes were allowed.

In transferring treated seed from one bag to another care has to be taken that the bags so used are either absolutely new or have been dipped in the solution to destroy any smut in them.

The result of the treatment was very conclusive. While the untreated plot contained at least 50 per cent. of smut, careful search over the treated plots failed to reveal a single smutty head. Thus both solutions were equally successful in destroying the smut, but it was noticeable that the plot treated with formalin looked much better, and was a little further advanced. Mr. Goldie also informed me that from the very start the formalin plot had a healthier appearance.

Barley Smut.

The same treatment was carried out with barley, but on a much larger scale Chevalier barley sown in the beginning of July was treated with formalin, 1 lb. in 40 gals., and a portion left untreated. It was reaped on 21st December, and while on the 20 acres treated not a single smutty ear could be seen, in the untreated portion there was not a single stook in which several smutty ears could not be detected. Mr. Goldie is naturally very pleased with the simplicity and efficacy of the formalin treatment, and will use nothing else in future.

Relative Merits of Formalin and Bluestone.

In comparing the two solutions of formalin and bluestone it must be remembered that formalin is volatile and non-corrosive, while bluestone is very corrosive; but the latter solution may be used again and again without becoming exhausted. It follows therefore that only the amount of formalin should be prepared that will be required for immediate use, and sprinkling should be preferred to dipping. The original formalin solution should be kept securely corked. The cost* will be practically the same, and the formalin is less injurious to the grain than bluestone. The corrosive action of the bluestone can be lessened by dusting powdered lime over the grain immediately after treatment, but this prevents sowing with the drill. The destruction of a certain proportion of the grain is not an unmixed evil, because it will act most injuriously on those already somewhat damaged, and consequently most likely to produce a weakened plant.

* Formalin, as made by the Schering's Hygienic Company, for which Messrs. Felton, Grimwade and Co., are sole wholesale agents, is packed in one pound original bottles, or can also be supplied in one gallon original bottles, price 2s. per pound, or 16s. per gallon.

A DAIRY FARM BUILDING.

By T. Cherry, M.D.

One of the most important points about the permanent improvements of the farm is the adoption from the commencement of a good plan for the buildings. The size and style will vary with the different branches of agriculture, but there are certain conditions that should be fulfilled in all cases. The building should be well adapted for its special purpose, it should be substantial and permanent so far as may be with due regard to its cost, and above all it should be so arranged that it can be extended, so as to keep pace with the growth of the farm. Farm buildings usually consist of a collection of small erections which have been built from time to time without any general plan. As a stable or barn becomes too small for the increasing requirements of its owner it is turned to some other use, and a new building takes its place. In this way a number of small buildings grow up, none of them perhaps as good as might have been built with the same money, and their inconvenient arrangement is a source of continual loss through the extra labour involved in carrying on the routine work of the farm.

During the last few years the so called "consolidated type" of farm building has come into favour in America. A large many storied building is made to serve all purposes, the upper stories being used for hay and grain, the intermediate one for implements and machinery, and the lower ones for the animals. In this way four and five stories are often met with. The only disadvantage is the liability to total destruction in case of fire, while in all directions the advantages are manifest. A large building costs less, both to build and maintain, than a number of small ones which provide the same amount of accommodation, while the saving in labour goes far towards providing interest and sinking fund on the capital cost of construction. The advantages are very evident in the winter, when all the work may be done with a minimum amount of exposure to the weather.

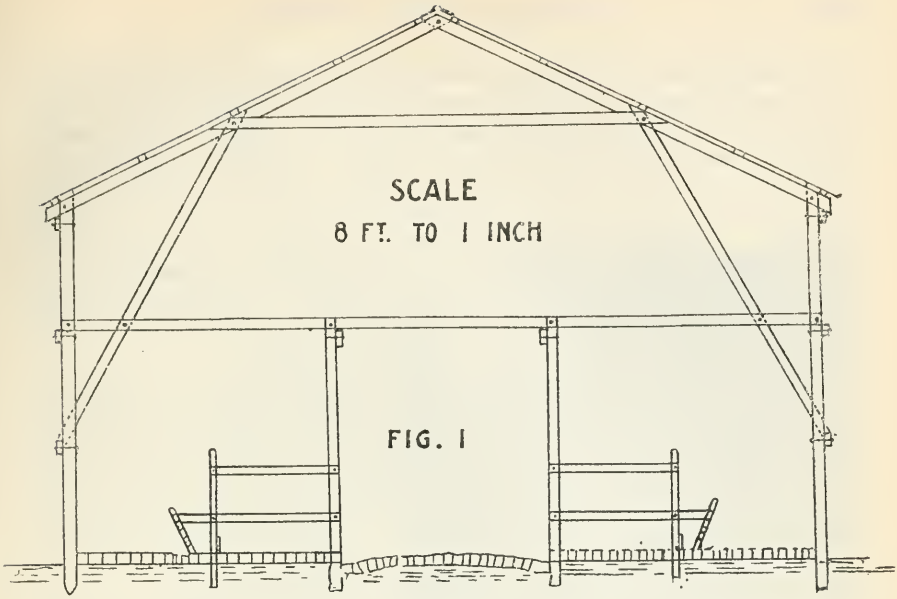
In connection with the dairy industry, plans for improved milking sheds have already appeared in the *Journal* for June, 1902. The present building is designed to meet the special requirements of the dairy farmer. It comprises a cow stable on the ground floor, and a large loft above which will answer all the purposes of an ordinary barn. As will be seen from Figs. 1 and 2, the building is 32 feet wide, a roadway 10 feet wide runs down the centre, the cows standing with their heads towards the walls. The framing is erected in sections of 8 feet each, an arrangement which enables the building to be gradually extended to any desired length. In order to secure this, the ordinary 4 x 2 framing is replaced by much heavier timbers, but the number of pieces of timber is much reduced, so that, on the whole, there is considerable saving in material. The longitudinal timbers are all 16 feet long, so that by "breaking joints" alternately on each

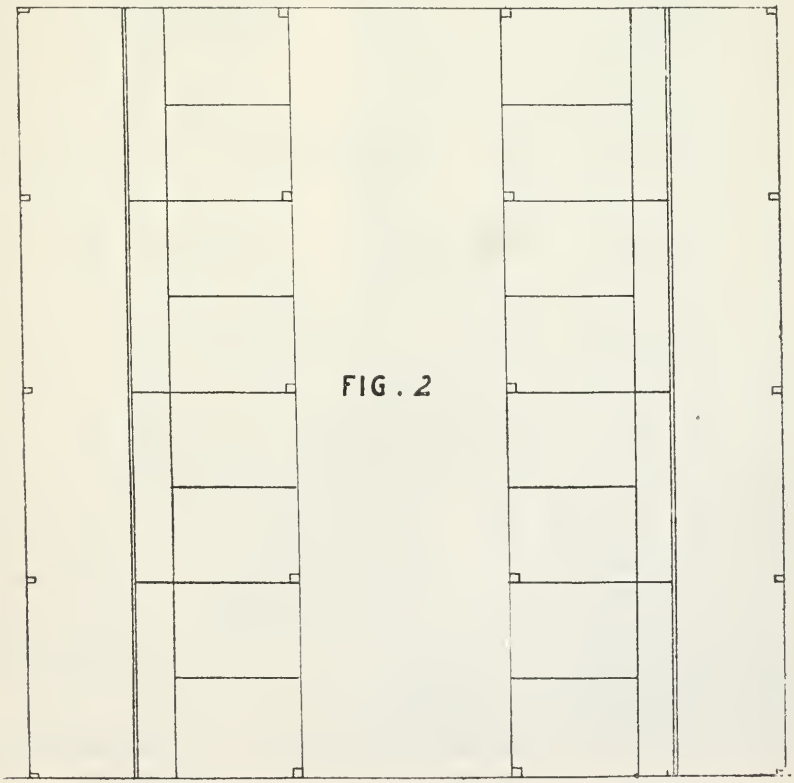
transverse principal the necessary strength is secured, whatever may be the length of the building. The building may be used either for feeding and shelter, or for milking in addition, according to the taste of the owner. The chief objection urged against milking in a building with a loft overhead, is that dust from the hay will fall into the pail. While this may be true if there is a faulty floor, it must not be forgotten that by far the greatest source of contamination of the milk is the dirt from the udders and hind quarters of the cows, and from the hands of the milkers. If the building is properly constructed, the cows groomed and scrupulous cleanliness observed, the number of stories above the cows is a matter of little consequence. Odours from the cows and bedding can be avoided by good ventilation and cleanliness. These matters are emphasised because the main point is to keep the attention directed to the principal evil. It is the little particles of cow dung which find their way into the milk which do more harm than all else combined. There is only one way of keeping these out of the pail, and that is care and attention on the part of the farmer. A good building for the milking shed is desirable, because the means necessary for securing this cleanliness are then more readily provided. But the most perfect shed will fail to secure clean milk if the owner is ignorant or careless. A very simple means of obtaining clean water, on the most primitive farm, is described in Mr. Carroll's article in the *Journal* for June, 1902.

Location and General Arrangement.

Besides convenience of access from the different paddocks and from the road, the farm buildings should be located at a lower level than the dwelling house, and if possible, in such a position that the prevailing winds blow from the house to the stable rather than *vice versa.* The distance should be from 50 to 100 yards, and some of the original trees should be retained or others planted, so as to make a break between the two. The trees not only afford a grateful shade in the summer, but they protect the home to a great extent from the flies and dust. When all the native trees have been destroyed and it is decided to make a plantation, the sugar gum and wattle are the best temporary trees, while the permanent ones may be selected from the blackwood, English oak and elm, *Pinus insignis* and *Cupressus lambertiana*, according to the locality. In wet districts a slab footpath, four feet wide, from the house to the milking shed will materially reduce the labor of keeping the home clean and tidy. The direction of the long axis of the building is not a matter of great importance, and if a better level can be obtained by departing from the cardinal points of the compass, there is no reason why this should not be done. In fact, a building facing the N.E. and S.W is in many localities the best.

As has been already mentioned, our plan is to begin the building by erecting one end in its permanent position and arrange so as to extend it as far as necessary in the opposite direction in sections of 8, 16 or 24 feet. If means can be secured for driving the hay wagon





TRANSVERSE SECTION AND PLAN OF BUILDING

up to nearly the level of the floor of the loft a great deal of labor will be saved in handling both the harvest and the silage, as the chaff-cutter may be placed on this floor, and all the feeding arrangements thus be reduced to the simplest possible condition. Should the building be placed on the side of a hill a bank of earth may be formed either at the end or against the side near the end of the building. In order to protect the wall from damp the excavation or earth work should be kept back from the wall for a space of two or three feet, and the earth prevented from falling in by slabs or saplings so as to allow the wagon to be backed hard up against the wall of the building.

The temporary end may be filled in with panels of either weather-boards or paling of about the same length and height as the panels of an ordinary paling fence. The rails are bolted to the studs and posts so that the same panels may be used again whenever the building is extended. A doorway at one or both ends is provided according to the size and location of the building and its relation to its surroundings.

Details of Construction.

As will be seen from the illustrations, the framing is of the simplest description. The studs are 6 x 4, and all the rest of the framing 6 x 2, or, if more convenient, saplings may be employed throughout. Half-inch bolts are used to bolt the various timbers together. No mortices or tenons are used, and the labour involved is thus reduced to a minimum. The principals are set up eight feet apart, this distance being selected because it allows two cows to stand together side by side. Three longitudinal plates, also 6 x 2, are bolted to the studs, one six feet from the ground floor, the second at nine feet to carry the ends of the floor joists, and the third just below the ends of the rafters. The following will be found the easiest way to begin the work. First set out the framing by laying the timbers of one of the principals on a level piece of ground in their relative positions, and bore the holes for the bolts. The distance between the two end bolts in the rafters is 17 ft. 3 in. The first set will then serve as a pattern for all the others. Then set up the studs and posts, brace them plumb, and bolt on the two lower longtiudinal plates and the floor joists. Then secure the brace on each side in its position by bolting it to the stud and floor joist. The rafters are lifted into position in the following way. Bolt the outer end of the right hand rafter in its place allowing its central end to rest on the ground near the middle of the building. Then take the left hand rafter, bolt its central end to that of its fellow, and using the left rafter as a pole raise the right hand one to its permanent position and fix it by the bolt at the top of the brace. The left rafter will then hang from its central bolt, its outer end is then carried up to its position and bolted to the top of the stud. The collar tie is then placed in position, and lastly the top longitudinal plate bolted on.

The roof is best covered with galvanised iron, two nine feet sheets being required for the building as shown in the illustrations. The

FIG. 3. FRAME IN COURSE OF ERECTION.

battens or purlins should be 3 x 3 hardwood bolted to the rafters. Five are required for each side if nine feet iron is used. They are 16 feet long, the joists being broken on each alternate rafter.

The walls are covered with weatherboards, short 3 x 2 studs being fixed between the main ones. The space between the lowest plate and the floor of the loft is arranged to meet all the necessary requirements for ventilation. This space on the side that faces the east in a well sheltered situation may be left open, as is the case on the side of the building away from the observer in Fig. 4; or it may be covered in as seen on the side next the observer in Fig. 4. Panels 8 feet long are hinged at the bottom so that in hot weather the whole of both sides may be left open. Ventilation in winter is provided by the spaces between the battens in the upper part of the panel, thus securing cross currents of air immediately under the floor of the loft.

The flooring joists are placed two feet apart, the ends being carried on a bearer bolted to the top of the central rows of posts. For the floor of the loft the best material is grooved and tongued softwood, but in many localities hardwood will be used as it is much cheaper. The main objection is the shrinkage. When the green boards are first laid this may be met by stretching a roll of building paper over the joists and nailing the flooring on top of it.* When the boards have become seasoned they may be taken up and the joints closed up. A shoot is provided in the corner at each side to allow the feed stuff to be sent down into the truck below.

As will be seen from Fig. 1 the ground floor is paved on two levels, the roadway down the middle being about 9 inches lower than the floor on each side. The part of the floor on which the cows stand runs back nearly level to the edge of the kerb where there is a single square step the full depth. This arrangement is preferable to the sloping sides of a gutter. In the latter case the animals slip about and are afraid to stand at their ease because they know that the foothold is insecure. When on a raised level platform, however, although their feet are close to the edge, they soon get to know that there is no danger of slipping, and act accordingly. The step up is made high so as to allow the manure to drop clear of the animals. The roadway along the middle of the building has a low crown to its centre and the gutter is formed by this slight curve meeting the kerb. As the cost of this floor is one of the main items in the total outlay involved in the construction of the building, it is important to use the resources of different localities to best advantage. Where bluestone, granite, or other hard rock is procurable it is best pitched throughout and grouted in cement. Where pitchers are not available, make a kerb of 9 x 3 red gum, and floor the platform and roadway for a yard on each side of the kerb with cement concrete. Many of the harder slates and sandstones found throughout central Victoria are suitable for this purpose, and quartz gravel makes excellent concrete. The remainder of the floor may be wood paved. Finally

* There are several brands of building paper, P & B, &c., procurable in Melbourne.

in parts of Gippsland and the northern plains, where stone of all kinds is out of the question, a wood floor set in tar asphalt is the best available. The object is not only to keep the cows dry, but also to keep them clean, and reduce the labor of removing the manure to a minimum. Good concrete made be made as follows:—

Coarse Gravel	..	2 parts	Coarse Sand	..	2 parts
Fine ,,	..	1 ,,	Cement ..	..	1 ,,

On a good foundation three inches of concrete will be sufficient.

The inside fittings may be modified to suit the ideas of the individual, one arrangement being shown in Figs. 1 and 2. The posts supporting the floor joists on each side of the roadway are used to carry one end of the division between the stalls. The mangers are 5 feet 6 inches from the kerb, and between the manger and the outside wall of the building there is a 4 feet race for feeding. A truck may be run along this, and the food passed down from the loft by means of a shoot in one corner. The mangers are simply made by means of an angle rail laid along the floor to form each corner, the front and back are formed of 6 x 1 hardwood, with a 4 x 2 to form the edge. The front of the manger is thus 10 inches and the back 18 inches from the floor. The lower rail between the cows may be carried forward to help in fixing the back of the manger, and, at the same time it will keep neighbouring cows from interfering with one another when feeding. Two cows thus stand side by side in each eight feet space. They are best tied up by chains, the eye of which slides up and down a 16 inch bolt fixed on the posts at the mangers. Bails may be easily fixed if they are required. No divisions are placed in the mangers to separate one cow from the other, except the end of the rail already noted. In this way the whole length of the manger may be cleaned out after each feeding.

The advantages of this system are as follow:—

1. Uncovered cow yards are done away with. The whole herd is under shelter and the milking is done with as much comfort as is possible.

2. The cows may be regularly fed to supplement the forage obtained in the paddock. This means a notable increase in the returns from each animal.

3. The cows are kept warm in winter nights. Straw or bracken fern may be used for bedding. In bracken districts this is the only way in which a pest can be turned into a valuable commodity.

4. The manure is easily secured. Each day a shovelful of dry earth is scattered at the rear of each cow. Next morning, after milking, a dray is taken through the shed, the manure removed, and carted out into a small adjoining paddock at once. It is ploughed under in the course of each fortnight. In this way a succession of fodder crops may be grown and it will be found that the increased

FIG. 4. GENERAL VIEW OF BUILDING.

returns from the cows represent from five to eight shillings per load from this manure.

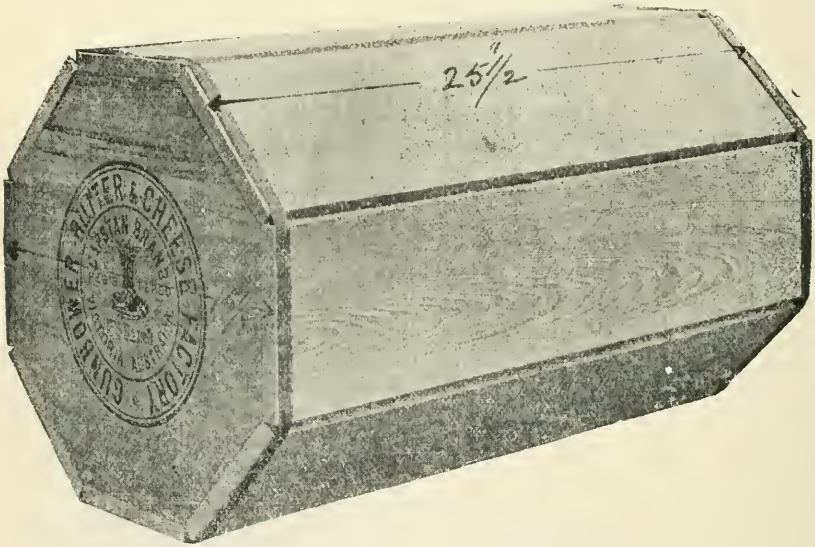
5. By the method described above, the building can be gradually extended to any length. The difficulty of breaking joints on alternate principals is met in the case of the purlins, by allowing half of their number to project eight feet beyond the end of the building until the extension is made. In the case of the side wall plates, an eight feet length is bolted between the last two principals on each side. When the extension is begun, this may be taken off and the 16 feet length substituted for it.

GENERAL NOTES.

The Carriage of Cheese.

During the recent warm weather parcels of cheese reaching Melbourne by rail and boat from the country arrived in very soft condition, and much harm to the quality occurred in consequence. However, far greater damage happens through forwarding them loose, especially when the weather is unfavorable. It stands to reason that cheese must get flattened out, broken, or misshapen, when heated, and two, three, or even more cheeses piled on top of each other. In a railway truck the result is bad enough, but in small steamers trading along the coast the cheese is frequently stacked on top of other goods and gets badly marked.

If it were packed in crates (as illustrated) for transit much of this loss would be obviated.



Cheese Crate to hold three 40 lb. Cheeses.

Two cheese-makers who were recommended to adopt crates have used the same packages for half a dozen consignments, and they appear to be good enough for six more trips. Those consignors have not had a cheese marked so far, therefore it is certain the use of crates will repay the slight cost and trouble many times over. The accompanying photographs have been taken, and sent to cheese-makers to show the state in which their cheese was landed in Melbourne for market.—*R. Crowe.*

Cheese Flattened and Misshapen in Transit.

Some of same Consignment landed in good order.

Cheese Bruised in Transit.

Some of same Consignment landed in good order.

Cheese Burst and Twisted in Transit.

Some of same Consignment which arrived safely.

Coating Cheese with Paraffin Wax.

The results of experiments with cheese kept under ordinary conditions, in a warehouse in Melbourne, show the advantage of coating with paraffin wax.

Four small cheeses were coated with paraffin wax on the 8th October and weighed 46¼ lbs., four duplicates were left plain and scaled the same weight (46¼ lbs.). The minimum temperature of the store for 14½ weeks was 58 degrees, whilst the maximum was 70 degrees, and the mean 65 degrees. On the 19th January, 1904, the cheese coated with wax weighed 44¾ lbs., and showed a loss of 1½ lbs. or 3·22 per cent., whilst the plain duplicates weighed 43½ lbs., and lost 2¾ lbs. or 5·91 per cent., showing a saving of 2·69 per cent. in weight in favour of the paraffin coating. The cheeses coated with wax were adjudged, by experts, to be superior in flavor and texture to those which were not so treated.—*R. Crowe.*

Analyses of Export Butters.

The following are the results of the analyses made by the Chemist for Agriculture of samples of twenty export butters, the samples being taken by the Dairy Expert at the Government Cool Stores.

No. of Sample.	Fat. %	Moisture. %	Soluble Salts. %	Curd. %	Ash. %
1	87 49	9·22	2·75	·51	·03
2	86·75	10 20	2·28	·74	·03
3	86·51	10 07	2 46	·92	·04
4	86 23	10 92	2·07	·74	·04
5	86·08	10 54	2 10	1·24	·04
6	85·83	10 94	2·92	·78	·03
7	85 45	10·64	2·68	·90	·03
8	85·32	12 88	1·40	·36	·04
9	85·30	13 18	·50	·99	·04
10	85 18	11 13	2·31	1 33	·05
11	85 01	12·91	·72	1·31	·05
12	84·91	13 61	·64	·80	·04
13	84·70	13·52	1·21	·53	·04
14	84·23	13 89	·89	·95	·04
15	83 71	14 36	1·42	·48	·03
16	83·27	13·10	2·52	1·07	·04
17	83 15	12·92	2·51	1 38	·04
18	82 63	13 75	2·61	·97	·03
19	82·62	14·04	2 60	·71	·03
20	82 54	13·81	2.34	1·26	·05
Average ..	84 84	12 28	1·94	·89	·03

R. Crowe.

Take-all and White-heads in Wheat.

The following notes, in addition to the article in the January number, appeared in Bulletin No. 9. :—

THE FUNGUS ON GRASSES.

In the summary on page 423 it is stated that the native grass or grasses on which the fungus occurs here are not known, but since then it has been found on the spear grass, *Bromus sterilis*, which is an introduced weed and widely distributed. On examining some sheaves of take-all wheat sent by Mr. Peters, of Muskerry East, several plants of spear grass were found with the base of the stem blackened, and the

Take-all patch in crop of Sullivan's Early.

perithecia or fruit cases of the fungus could be seen by the naked eye. On submitting these to microscopic examination the characteristic spores of the *Ophiobolus* were met with, and the evidence was complete as to this grass being a harbour for the pest. Just as in the case of wheat, the grains in some of the ears were formed, while in others they were empty.

It is an important point in the life-history of any fungus parasite to know the particular plants on which it grows and can survive from season to season, so that they may be kept down and destroyed as far as possible. The destruction of this weed then will be one of the means of preventing the spread of this fungus, and generally clean cultivation will be found profitable.

On wheat-grass, *Agropyron scabrum,* similar mycelium to that shown in Figs. 3, 4, 5, 6, 7 & 8 was observed, but none of the fruiting portion, hence it is not yet absolutely proved that this grass harbours the fungus, though it is strongly suspected of doing so.

INFECTION EXPERIMENTS.

Further observations have been made in connection with the pot experiments referred to on page 416, and now not only has the mycelium been produced but even the perithecia or fruiting stages of the fungus. Wheat stubble affected with the take-all fungus was received from Mr. Peters and placed in pots on 5th November. In three of these pots Rerraf wheat of 1902 crop was sown on 9th November, and another pot had wheat sown without any addition of the fungus, in order to serve as a check. On examination, 15 days afterwards, brownish spots were seen on sheath and stem, and the microscope revealed the young mycelium identical with that shown in Fig. 6. The plants were nearly all of an unhealthy colour and sickly looking, and the fungus was evidently beginning to sap their vitality.

When again examined, 39 days after sowing, the mycelium as seen in Figs. 3, 5, 6 & 7 was very plentiful, and the perithecia were just beginning to form. Many of the plants were now dead, and the others were mostly in a dying state.

When finally examined, on 31st December, the perithecia were plentiful, containing asci and spores, and thus in 52 days after sowing, wheat plants had become thoroughly infested with *Ophiobolus graminis* and were producing the spores in abundance, capable of giving rise to a new generation of the fungus. The plants in the infected pots were almost all dead, while the plants in the check pots were healthy, green and fresh.

It has now been proved conclusively, both by the examination of numerous patches in the field and by cultures carefully conducted in pots, that the fungus *Ophiobolus graminis* is the cause of take-all and white-heads with us, and by adopting the necessary measures to starve out or destroy, or enable the wheat-plant to resist the fungus, this dreaded scourge may be banished from our midst. And since this fungus also occurs on spear-grass, it is an evident means of keeping it in check, to ruthlessly destroy this grass in the vicinity of wheat paddocks and especially on headlands.

Effects of Grafting.

A paper was read by L. Ravaz, at the International Congress of Agriculture at Rome in 1903, relating experiments with the grafting of European and American vines. The results showed that cuttings made from Vinifera grapes grafted on American stocks are no more resistant to Phylloxera than cuttings from Vinifera stocks. It was further demonstrated that the quality of the Vinifera fruit was in no way injured by grafting on American stocks for a period of years,

neither was the quality of the fruit of American vines improved by grafting on improved varieties of Vinifera.

Die-back.

This term, so generally employed to indicate the dying back of branches of fruit trees, is a somewhat unfortunate one. The expression as used in this State embraces the injury resulting from the various fungi which cause "root rot," principally the honey agaric *(Armillaria mellea)*, the symptoms presented by trees attacked by the root borer (*Leptops hopei*), as well as the common failure due to unsuitable physical condition of certain soils. As in the first two cases we are able to point to certain parasites as the cause of the trouble it would be more satisfactory if the use of the term "die-back" were restricted to the evils resulting from influences less obvious, such as improper physical conditions of the soil. In this latter connection, referring to the trouble as manifested in the dry climate of California, where fruitgrowing is carried on under irrigation, and where the conditions existing are aproximately the same as those in many of the northern districts of this State, Professor E. W. Hilgard, of the California University Experiment Station, makes the following trenchant remarks :—"Few persons outside the Experiment Station can have an idea of the extent to which the planting of orchards on shallow soils underlaid by hard pan or heavy clays has caused pecuniary loss, often almost ruin, to old-timers as well as new-comers to the State. Every few days there comes to us at Berkeley letters transmitting samples of tree branches having the "die-back," and asking about the means of relief. We might usefully stereotype the first letter in reply to such inquiries, briefly to the effect : 'Examine your subsoil !' In nine cases out of ten, it is either the hard pan, or an impervious clay substratum, which deflects the roots sideways after the second or third year, and, of course, prevents a normal development towards the moist depths of the soil, where abundant plant food awaits them in all good orchard lands. More rarely it is a layer of coarse sand, or gravel, which prevents the rise of moisture from below ; sometimes it is the rise of the bottom water which causes the disease of the deeper roots, and also starves the tree. Almost invariably the question is asked : 'What fertiliser must I apply to remedy the trouble ?' Well in most cases no fertiliser of any kind will remedy the difficulty, the existence of which should have been ascertained before planting the orchard, or, better, before buying the land at all. . . . However important is the presence of plant-food ingredients in the soil, the fundamentally needful point is *proper physical condition* without which no amount of fertilization, or natural productiveness is of any avail. All understand the need of moisture ; but unless care is taken to see that it gets where it will do the most good, and that the roots can perform their functions in the depths of the soil, water, work, and fertilisers may alike be wasted."

Putrefactive Mildew of Cabbage and Cauliflower.

The moist season is very favorable to the development of various diseases, and especially so in market gardeners' seed beds. Mr. Geo. Massee, of the Kew Gardens, England, describes a method in the *Journal of the Royal Horticultural Society*, of preserving tomatoes and cucumbers grown under glass from the attacks of mould fungi. This treatment is well worthy of trial by gardeners whose young cabbage seedlings show the characteristic spotting and blackening of the leaves due to the mildew *(Peronospora parasitica)*.

The method is to commence watering the young seedlings when a fortnight old, every third day with one ounce of bluestone in 50 gallons of water.

AGRICULTURAL CLASS AT NHILL.

Lecturers.

F. E. Lee, Travelling Assistant to the Chemist for Agriculture.—*Manures and Animal Nutrition.*
G. H. Adcock, Viticultural Inspector.—*Agricultural Botany and Viticulture.*
E. Meeking, Orchard Inspector.—*Insect Pests and Plant Diseases.*
H. S. Rudduck, Veterinary Surgeon.—*Veterinary Subjects.*
W. Haile, Wool Expert.—*Sheep Breeding and Wool Sorting.*
H. N. Hawkins.—*Poultry Breeding and Management.*
W. C. Robertson, Analyst.—*Theoretical and Agricultural Chemistry.*
G. H. Robinson, Assistant to Vegetable Pathologist.—*Diseases of Cereal Crops.*
A. Hart, Poultry Expert.—*Demonstrations in Poultry Dressing.*
J. Kenneally, Farrier.—*Demonstrations in Shoeing, etc.*
D. M. Boyd.—*Land Surveying, Stack and Dam Measurement.*
J. Lalor.—*Cattle Speying and Horse Breaking.*

Programme of Lectures.

FIRST WEEK.

March.			
Tuesday	1st,	P.M. 3-4.—Introductory lecture on the principles of manuring ...	Mr. Lee
Wednesday	2nd,	A.M. 10.30.—Land surveying, stack and dam measurement ...	Mr. Boyd
		P.M. 2-3.—Farmyard manure ...	Mr. Lee
		3-4.—Introductory lecture on principles of chemistry ...	Mr. Robertson
		4-5.—Insect pests and plant diseases	Mr. Meeking
Thursday	3rd,	A.M. 10.30.—Land surveying, stack and dam measurement ...	Mr. Boyd
		P.M. 2-3.—Lime and its functions in agriculture	Mr. Lee
		3-4.—Theoretical chemistry ...	Mr. Robertson
		4-5.—Insect pests and plant diseases	Mr. Meeking
Friday	4th,	A.M. 10.30.—Land surveying, stack and dam measurement ...	Mr. Boyd
		P.M. 2-3.—How to cultivate for wheat growing	Mr. Lee
		3-4.—Theoretical chemistry ...	Mr. Robertson
		4-5.—Insect pests and plant diseases	Mr. Meeking

SECOND WEEK.

		P.M.	
Monday	7th,	2-3.—Commercial fertilisers ...	Mr. Lee
		3-4.—Theoretical chemistry ...	Mr. Robertson
		4-5.—Valuation of artificial manures	Mr. Lee
		A.M. P.M.	
Tuesday	8th,	10-1—Demonstration of breaking and handling horses ...	Mr. Lalor
		P.M.	
		2-3.—Theoretical chemistry ..	Mr. Robertson
		3-5.—Veterinary science ...	Mr. Ruddnck
		A.M. P.M.	
Wednesday	9th,	10-1.—Demonstration of breaking and handling horses ...	Mr. Lalor
		P.M.	
		2-3.—Theoretical chemistry	Mr. Robertson
		3-5.—Veterinary science .	Mr. Ruddnck
		8-10.—Veterinary science .	Mr. Ruddnck
		A.M. P.M.	
Thursday	10th,	10-1.—Demonstration of cattle speying	Mr. Lalor
		P.M.	
		2-3.—Manures for the Northern areas	Mr. Lee
		3-4.—Agricultural chemistry ...	Mr. Robertson
		4-5.—Seeds—structure and development	Mr. Adcock
Friday	11th,	2-3.—Rotations and their possibilities in the North ...	Mr. Lee
		3-4.—Agricultural chemistry ...	Mr. Robertson
		4-5.—The plant—stem, bud, leaves and their functions ...	Mr. Adcock

THIRD WEEK.

		P.M.	
Monday	14th,	2-3.—The principles of stock feeding	Mr. Lee
		3-4.—Agricultural chemistry ..	Mr. Robertson
		4-5.—Flowers–arrangement, structure, and fertilisation ...	Mr Adcock
Tuesday	15th,	2-3.—Food requirements of the working horse	Mr Lee
		3-4.—Agricultural chemistry ...	Mr. Robertson
		4-5.—Fruit—structure and methods of seeding	Mr. Adcock
		A.M. P.M.	
Wednesday	16th,	10-1.—Care of foals, treatment of feet	Mr Kenneally
		P.M.	
		2-3.—Agricultural chemistry ...	Mr. Robertson

		P.M.	
		3-5.—Importance of poultry industry, locality, etc. ...	Mr. Hawkins
		A.M. P.M.	
Thursday	17th,	10-1.—Shoeing, surgical shoes, fitting, etc.	Mr. Kenneally
		P.M.	
		2-3.—Agricultural chemistry ...	Mr. Robertson
		3-5.—Breeds of poultry, food and feeding, etc.	Mr. Hawkins
Friday	18th,	2-3.—Agricultural chemistry ...	Mr. Robertson
		3-5.—Poultry diseases—cause and cure; chickens, etc. ...	Mr. Hawkins
		8-10.—The poultry industry ...	Mr. Hawkins

FOURTH WEEK.

		P.M.	
Monday	21st,	2-3.—Diseases of cereals ...	Mr. Robinson
		3-4.—Agricultural chemistry ...	Mr. Robertson
		4-5.—Diseases of cereals ...	Mr. Robinson
Tuesday	22nd,	2-3.—Agricultural chemistry ...	Mr. Robertson
		3-5.—Demonstrations in poultry dressing	Mr. Hart
		8-10.—Demonstrations in poultry dressing	Mr. Hart
Wednesday	23rd,	2-3.—Agricultural chemistry ...	Mr. Robertson
		3-5.—Sheep breeding, wool shearing, preparation ...	Mr. Haile
Thursday	24th,	2-3.—Agricultural chemistry ..	Mr. Robertson
		3-5.—Large clips, skirting, rolling, etc.	Mr. Haile
Friday	25th,	2-3.—Agricultural chemistry ...	Mr. Robertson
		3-5.—Small or farmers' clips, classing, etc.	Mr. Haile

Notice to Secretaries of Agricultural Societies.

Similar arrangements will be made for other classes to be held during the months of June, July, and August, in centres where at least 40 farmers and farmers' sons are enrolled before 15th April.

The above conditions must first be complied with, and the sanction of the Hon. the Minister of Agriculture obtained before a class can be held.

S. WILLIAMSON WALLACE,
Director of Agriculture.

RAINFALL IN VICTORIA.

MONTHS OF DECEMBER, 1903, AND JANUARY, 1904.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in Dec., 1903.	Average rainfall for each Area for the month of Dec. based on all previous years of record.	Maximum fall recorded within each Area during Dec., 1903.	Actual Average rainfall recorded in each Area in Jan., 1904.	Average rainfall for each Area for the month of Jan., based on all previous years of record.	Maximum fall recorded within each Area during Jan., 1904.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	0·77	1·38	1·46 at Tyrrell Downs	1·29	0·74	1·70 at Rainbow
B	0·92	1·31	1·72 ,, Horsham	1·36	0.96	1·69 ,, Apsley
C	1·01	1·74	1·75 ,, Terang	2·50	1·39	3·47 ,, Ararat
D	1·63	2·18	2·08 ,, Cape Patton	3·09	1·57	2·84 ,, Cape Otway
E	1·96	1·30	4·79 ,, Echuca	2·40	0·85	3·46 ,, Echuca
F	2·63	1·69	4·46 ,, Shepparton	2·96	1·27	6·22 ,, Shepparton
F^1	1·68	2·00	2·42 ,, Euroa	5·04	1·36	6·83 ,, Seymour
F_2	2·04	2·82	2·65 ,, Tallangatta	3·77	2·08	4·42 ,, Yackandandah
G	1·89	1·78	3·62 ,, Avoca	3·77	1·24	6·99 ,, Kyneton
H	1·29	2·19	1·38 ,, Daylesford	6·60	1·57	6·79 ,, Kilmore
I	2·18	1·98	2·68 ,, Teesdale	4·30	1·46	5·68 ,, Melbourne
I^1	2·95	3·01	4·34 ,, Dandenong	5·66	1·78	6·78 ,, Dandenong
K	2·89	4·01	5·81 ,, Warburton	5·04	2·26	8·57 ,, Warburton
L	2·47	3·32	3·35 ,, Alberton P.O.	3·45	2·46	4·81 ,, Alberton P.O.
M	—	2·26	3·19 ,, Gabo	—	2·39	2·96 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

EXPORTS FOR THE YEARS 1903 AND 1902.

Description of Produce.		Quantities. 1903	Quantities. 1902	Values, C.I.F. 1903	Values, C.I.F. 1902
Butter..	lbs.	28,379,881	15,040,029	£1,270,000	£684,828
Milk and Cream	cases	20,414	18,315	25,518	22,893
Cheese .. .	lbs.	1,706,672	797,438	42,666	19,935
Ham and Bacon	,,	2,876,995	3,387,411	107,887	127,028
Eggs	dozen	49,468	67,428	2,473	3,371
Poultry	head	119,375	175,658	29,844	43,915
Rabbits and Hares ..	pairs	3,501,097	3,274,210	218,818	204,638
Mutton and Lamb ..	carcases	305,878	416,395	183,526	249,832
Veal	,,	6,856	4,340	6,856	4,340
Pork	,,	1,928	1,620	3,856	3,240
Beef	qrtrs.	8,802	3,500	35,208	14,000
Fruit	cases	132,889	172,102	66,444	86,050
Fruit Pulp	,,	36,440	23,472	21,864	14,083
				£2,014,960	£1,478,153

DELIVERIES FROM THE GOVERNMENT COOL STORES, FOR THE YEARS 1903 AND 1902.

Description of Produce.		Quantities. 1903	Quantities. 1902	Values C.I.F. 1903	Values C.I.F. 1902
Butter..	lbs.	15,103,704	5,868,800	£674,300	£267,240
Milk and Cream	cases	10,003	10,322	12,503	12,903
Rabbits and Hares ..	pairs	1,803,239	2,090,945	112,702	130,684
Poultry and Game ..	head	33,830	118,142	8,504	29,283
Eggs	dozen.	95,789	76,408	4,789	3,820
Mutton and Lamb ..	carcases	94,884	163,421	52,186	89,880
Pork	,,	600	208	1,200	416
Veal	,,	1,946	1,190	1,946	1,190
Beef	qrtrs.	1,419	594	5,676	2,376
Fruit	cases	17,358	7,489	8,679	3,742
Fruit Pulp	,,	378	3,715	226	2,220
Sundries	lbs.	57,888	75,739	725	946
				£883,436	£544,700

R. CROWE.

EXPORTS FOR DECEMBER, 1903 AND 1902, AND JANUARY, 1904 AND 1903.

Description of Produce.		December. 1903.	December. 1902.	January. 1904.	January. 1903.
Butter..	lbs.	6,034,740	2,132,019	3,971,856	2,049,836
Milk and Cream	cases	360	320	875	1,335
Cheese	lbs.	116,478	134,892	96,200	34,260
Ham and Bacon	lbs.	34,280	21,400	140,160	46,340
Eggs	dozen	1,368	—	1,756	135
Rabbits and Hares ..	pairs	74,636	132,240	61,848	295,368
Poultry	head	3,765	6,360	2,890	7,385
Mutton and Lamb ..	carcases	28,001	107,299	15,820	93,294
Pork	,,	67	—	68	—
Veal	,,	758	982	214	1,248
Beef	quarters	81	86	192	76
Fruit	cases	1,699	207	1,219	649
Fruit Pulp	,,	8,909	2,406	26,941	2,420

DELIVERIES FROM THE GOVERNMENT COOL STORES FOR DECEMBER, 1903 AND 1902, AND JANUARY, 1904 AND 1903.

Description of Produce.		December. 1903.	December. 1902.	January. 1904.	January. 1903.
Butter..	lbs.	4,436,656	884,520	2,637,856	1,374,520
Milk and Cream	cases	687	723	653	1,035
Eggs	dozen	250	507	—	135
Poultry	head	535	5,683	—	7,385
Rabbits and Hares ..	pairs	60,636	127,826	45,672	188,071
Mutton and Lamb ..	carcases	4,160	81,030	760	28,412
Beef	quarters	—	—	2	20
Veal	carcases	22	591	—	432
Pork	,,	73	—	71	—
Fruit	cases	1,638	—	2,175	—
Fruit Pulp	,,	—	—	2,600	—
Sundries	lbs.	9,052	4,829	5,403	1,700

R. CROWE.

ARRIVALS IN MELBOURNE OF BUTTER and Butter ex Cream in Tons net, by Rail and Steamer from the different districts, for the years 1903 and 1902, and Januuary 1904

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
January ..	1985	1879	362	358	66	127	870½	817	686½	577
February ..	1383½	1301½	90⅓	206	51½	50	814	630	427½	415½
March ..	1371	977⅓	112	92	27	25	740½	650	491½	210⅓
April ..	910½	597½	140	60	14½	16	443	359	313	162½
May* ..	794	670	137	95	14	13	354	421	289	141
June ..	595½	473	118	40	13½	22	213	247	251	164
July ..	561½	435½	106	54½	16½	17	179	190	260	174
August ..	641	468	163	99	33	24	122	122	323	223
September ..	1288	1042	323½	216	87½	63	317	267	560	496
October	2122	1807	439	360	174	92	697	567	812	788
November ..	2750	2049	622	430	201	94	943	787	984	738
December ..	2756	1995	528	358	194	83	1026	860	1008	694
Totals ..	17,158	13,695	3141	2368½	892½	626	6719	5917	6405½	4783½
	1904.	1903.	1904.	1903.	1904	1903.	1904.	1903.	1904	1903.
January	2220	1985	403	362	150	66	917	870½	750	686½

*Including 350 tons which it is estimated came by road during the strike.

R. CROWE

Fruit and Plants.

EXPORTS to Australian States and New Zealand, Inspected during December, 1903, and January, 1904.

Fruit.	Cases or Packages Inspected.		Certificates Given.	
	December.	January.	December.	January.
Apples	112	919	39	131
Apricots	4367	908	266	157
Bananas..	2647	1242	372	269
Blackberries	—	1	—	1
Blackcurrants	1	—	1	—
Cherries	3753	59	325	18
Cucumbers	210	107	119	43
Figs	4	6	3	2
Gooseberries	522	—	28	—
Grapes	8	523	1	145
Lemons	936	713	128	66
Loquats	6	—	4	—
Mixed Fruits	—	4	—	2
Nectarines	60	111	31	61
Oranges	611	164	181	61
Passion Fruit	3	22	2	10
Peaches	359	1472	255	265
Pears	—	6205	—	127
Pineapples	548	249	185	98
Plums	303	1030	109	125
Raspberries	8	—	7	—
Tomatoes	—	583	—	120
Plants	17	1	11	1
Totals	14,475	14,319	2067	1702

J. G. TURNER,
For C. French.

PUBLICATIONS ISSUED BY THE DEPARTMENT.

Bulletins.

Reprinted from the Journal.

No. 1. Impressions of Victoria from an Agricultural Point of View. By S. Williamson Wallace.
No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
No. 3. *Black Spot of the Apple; together with Spraying for Fungus Diseases. By D. McAlpine.
No. 4. Review of the Past Butter Season. By R. Crowe.
No. 5. Two Years' Field Work of the Chemical Branch. By F. J. Howell, Ph. D.
No. 6. Co-operative Forage Experiments in Southern Victoria. By F. J. Howell, Ph. D.
No. 7. Field Experiments of the Past Year by the Chemical Branch. By F. J. Howell, Ph. D.
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No. 9. Take-all and White-heads in Wheat. By D. McAlpine.
No. 10. Cheese Maturing at Low Temperatures. By R. Crowe.
No. 11. A Dairy Farm Building. By T. Cherry, M.D.

* Out of Print.

Guides to Growers.

No. 19. Lavender. By J. Knight.
No. 20. Broom Corn. By J. Knight.
No. 24. The Fig Industry. By C. B. Luffmann.
No. 26. Treatment of the Raisin Vine. By C. B. Luffmann.
No. 28. Regulations under the *Vegetation Diseases Act* 1896.
No. 41. Cider-making. By J. Knight.
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No. 47. Manures in the Victorian Market. By A. N. Pearson.
No. 49. Codlin Moth Experiments. By C. French.

Revised List of Fruit Trees, &c., Recommended for Cultivation as Suitable for Marketing, Canning, Drying, Exporting, &c.
Modern Dairying. By D. Wilson and R. Crowe.
Report on the Preservation of Fruit for Shipment. By J. M Sinclair.
Report on Meat Inspection in the United States. By J. M. Sinclair.
The Butter Industry of Victoria and the British Export Trade. By J. M. Sinclair.
Prospectus and Regulations of the Agricultural College and the School of Horticulture, with Syllabus of Instruction.
Poultry Breeding and Management for the English Markets.
Report on Successful Farming in the Mallee. By F. J. Howell, Ph. D.
List of Butter and Cheese Factories in the State of Victoria.

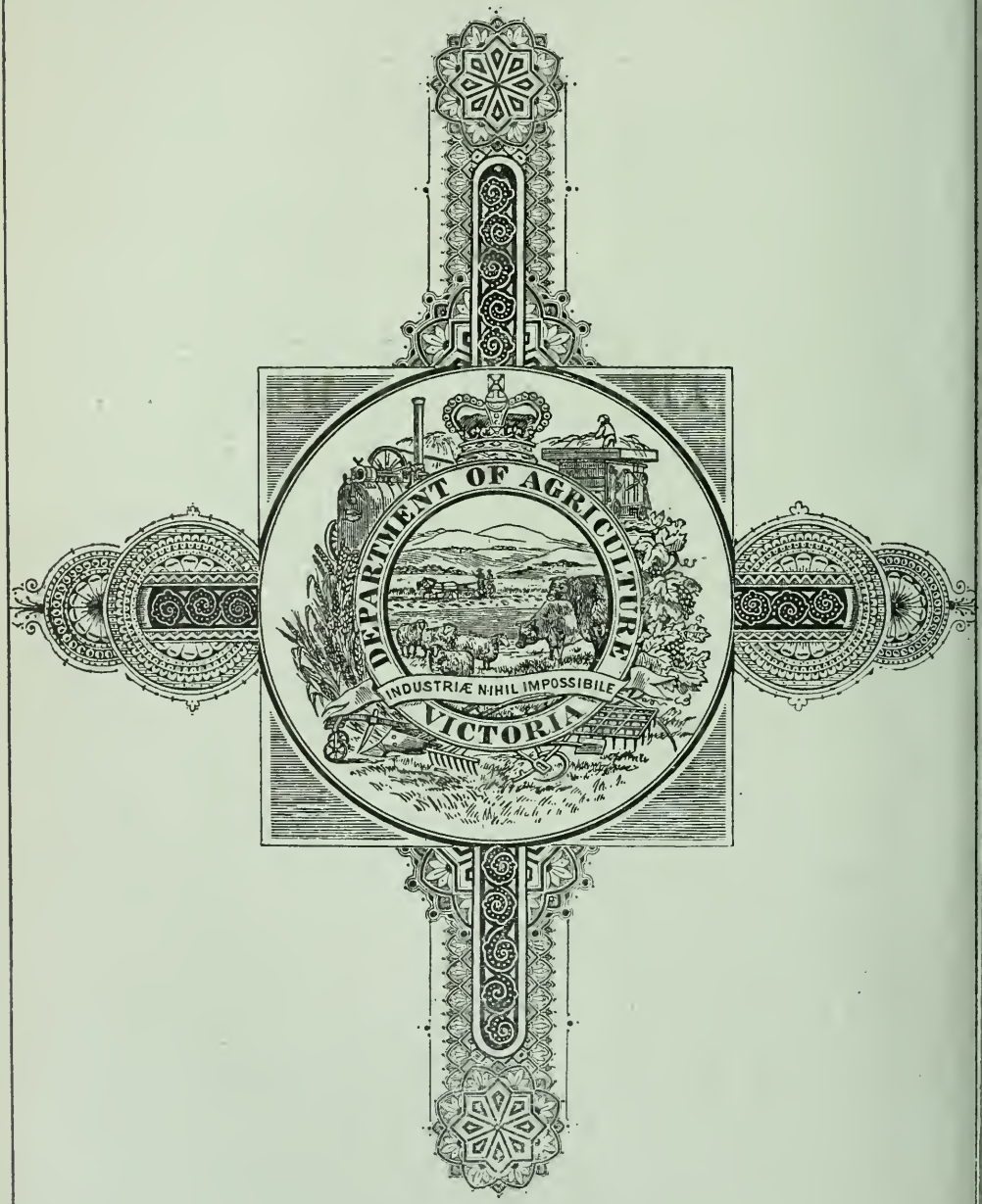
The New Agriculture. By the Hon. I. A. Isaacs.
The Beet Sugar Industry in Victoria. By A. N. Pearson.
List of Exporters of Agricultural Products.
The Scientific Directing of a Country's Agriculture. By A. N. Pearson.
Additions to the Fungi on the Vine in Australia. By D. McAlpine.
Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
Chart for the Guidance of Dairymen. By R. Crowe, Dairy Expert.
Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
Report of Conference on the Elevator System in the Handling and Shipment of Grain.
Annual Reports, 1899, 1900 and 1901.

Any of the above may be had Free, on application to the Secretary for Agriculture.

Destructive Insects of Victoria, Parts I., II., III. By C. French. Price 2s. 6d. each.
Fungus Diseases of Citrus Trees in Australia. By D. McAlpine. Price 2s.
Fungus Diseases of Stone Fruit Trees in Australia. By D. McAlpine. 165 pp., 10 colored plates. Price 2s. 6d.
Australian Fungi. By Dr. Cooke. Price £1 1s.

Works on Viticulture. Translated from the French by R. Dubois and W. Percy Wilkinson.

Wine-making in Hot Climates. By L. Roos. 273 pp., 61 illustrations, 5 plates. 1900. Cloth-bound, 2s.
First Steps in Ampelography. By Marcel Mazade. 95 pp., 43 illustrations. 1900. Cloth-bound, 1s.
Trenching and Sub-soiling for American Vines. 171 pp., 110 illustrations, 10 plates. 1901. Cloth-bound, 2s.
New Methods of Grafting and Budding as applied to Reconstitution with American Vines. 72 pp., 89 illustrations. 1901. Cloth-bound, 1s.
American Vines: Their Adaptation, Culture, Grafting, and Propagation. By P. Viala and L. Ravaz. 297 pp., 150 illustrations, 10 colored plates. 1901. Cloth-bound, 3s. 6d.
Studies on Wine-sterilizing Machines. By U. Gayon. 103 pp., 45 illustrations, 2 colored plates. Cloth-bound, 2s.
Manual of Modern Viticulture; Reconstitution with American Vines. By G. Foëx. 270 pp., 5 colored plates. Paper covers, 1s. 6d.


DEPARTMENT OF AGRICULTURE
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May

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THE JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

VICTORIA.

PUBLISHED FOR AND ON BEHALF OF THE GOVERNMENT BY DIRECTION
OF THE

HON. JOHN MURRAY, M.L.A.,
Minister for Agriculture.

EDITED BY D. McALPINE.

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1904

The Journal is now issued bi-monthly, that is to say, every alternate month. The Minister of Agriculture has directed that a charge of 2s. 6d. per annum shall be made, and to persons outside the State the charge will be 3s. 6d. Those who desire to receive future issues must, therefore, remit that amount without delay to the Secretary for Agriculture.

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To the Secretary for Agriculture,
Melbourne.

Sir,

Herewith I beg to forward the sum of two shillings and sixpence (2s. 6d.), being subscription to the Journal of Department of Agriculture for the year ending 30th June, 1905.

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AGRICULTURAL JOURNAL OF VICTORIA.

MAY, 1904.

FIELD EXPERIMENTS IN MANURING, 1903-4.

By F. J. Howell, Ph. D.

1. Hay Manuring Experiments.

The co-operative manuring experiments in Southern Victoria conducted during the season 1902-3 afforded facts of great value to the Southern grower. The marked operative effect of phosphatic manures in these experiments in the production of increased yields revealed a response to applications of phosphoric acid in the bulk of Southern soils, almost as striking as earlier experiments in Northern areas had shown to be the case in that part of Victoria. A new fact brought to light in the Southern experiments which might be accepted as contradictory of earlier Northern results appeared to be the large contributory share in the production of increased yields which applications of nitrogenous manures might be expected to play in certain crops of Southern agriculture. With respect to potash, the effective action of additions of this ingredient in the majority of the fields of the South agreed with what appeared to be the universal experience in the North. There appeared, however, indications that on certain types of soil in the South, potash might require to enter into consideration in a system of manuring intended for the production of maximum crops.

The experiments conducted during the season of 1902-3 were, it will be remembered, carried out under climatic conditions which might be regarded as exceptional. The country is just emerging from the serious position which followed as the result of these conditions. It appeared then necessary to seek confirmation of returns obtained under such conditions by results secured under more normal circumstances. The experiments in the South were, therefore, repeated over a large area, and in a more comprehensive way last year, and although the rainfall of this year inclined rather to the other extreme than the normal, the results taken together with the experience of the preceding year, may be accepted as a basis for expressing opinions generally as to manurial requirements. It is satisfactory to find that the results of two extreme seasons agree in the main points the experiments were intended to elucidate, and that the knowledge gained may be regarded as of distinct value to the agriculturist.

The System of Experimenting.

All the tests were carried out in co-operation with farmers who provided the land and gave the necessary assistance in putting in and taking off the crops. Special efforts were made in the present tests to gain regular and reliable results. Each crop was sown by a Government field officer with a grain drill specially adapted for the continuous regular discharge of fertilizer and seed. The crops were inspected during growth by the officer who himself applied the top dressings where necessary. Each plot was harvested with the binder and stooked under the supervision of the officer, and the same precautions were afterwards observed in weighing results. Prior to the sowing of the crop, the land which had been set aside for the purpose by the farmer, was inspected with a view to determining its suitability. In a percentage of cases there was not that regularity in the nature and treatment of the soil which is so desirable a feature in tests of this character. Depressions and rises, clay or sand patches introducing differences in both chemical composition and mechanical character, finishing furrows and other disturbing factors not considered deserving of notice by the ordinary observer, but of supreme concern to the experimenter, were too frequently present, all helping to contribute in places to those irregularities in returns which at times appear to flatly contradict results obtained from another portion of the field. It will be recognized, however, that these are conditions which must be expected, and to an extent accepted in any system of co-operative farm experimenting. They may be met, and their disturbing effects largely obviated by the elimination of returns from portions of a field so affected; by the introduction of double checks and by the consideration of the average returns of large numbers of fields in which individual irregularities are made to disappear, and certain broad features generally characteristic of the soils of a district brought into prominence. It must be recognised, however, that under the most favorable circumstances the conditions for experimenting obtaining on a farm can never equal those possible at an Experiment Station where continuous takes the place of intermittent observation, and where the selection of locality, the preparation of the soil, time of sowing and time of harvesting can be suitably arranged, and the whole set of operations adjusted to the attainment of an ideal set of conditions. But admitting disadvantages in these particulars, a wide system of co-operative field tests carries advantages in other directions, and the Victorian farmer, I think, has recognized the fact.

The Area Covered in Each Experiment.

The area required for the field manure test on each farm amounted to 1⅓ acres. The plan will show the size of the field and the arrangement, width and length of the various plots. For ease in working, the width of each plot was made to correspond to one sweep of a small fertilizer drill. This width also adapted itself to easy harvesting

by one sweep of the binder. There were 24 plots in each field, protected by two additional outside border plots. The plan presented below was forwarded early in the season to each farmer who had made application to carry out the tests, and instructions for preparing the necessary area and a statement of conditions accompanied the plan.

396 feet long (6 chains). Total area $1\frac{23}{40}$ acres.
Each plot is $\frac{1}{20}$ of an acre.

The farmer was required to have the field in readiness on the arrival of the officer. Although uniformity was maintained as regards the size and arrangement of the field throughout the whole of the South, there were variations introduced as regards the manures used. These variations were with the object of meeting differences in climatic conditions, and taking in a wider range of tests than would be possible in a single field of the area specified. There were therefore, three sets of manures made up, designated G, O and O2 respectively. The sets O and O2 differed little in their make up. In the O2 set potash was given in the form of the sulphate instead of the chloride. The combinations employed in the three sets are given below. The numbers of the plots correspond with the numbers on the plan.

Manures Used in the Various Sets.

Set G.

Manures Used per Acre.

Plot 1.—1 cwt. ordinary superphosphate.
,, 2.—No manure.
,, 3.—2 cwt. ordinary superphosphate.
,, 4.—3 ,, ordinary superphosphate.
,, 5.—No manure.
,, 6.—2 cwt. ordinary superphosphate.
$\frac{2}{3}$,, potash sulphate.
,, 7.—1 ,, ordinary superphosphate
$\frac{1}{3}$,, potash sulphate.
,, 8.—No manure.
,, 9.—$\frac{2}{3}$ cwt. potash sulphate.
1 ,, sulphate of ammonia.

Plot 10—$\frac{2}{3}$ cwt. potash chloride.
1 ,, sulphate of ammonia.
,, 11.—No manure.
,, 12.—2 cwt. ordinary superphosphate.
1 ,, sulphate of ammonia.
,, 13.—1 ,, ordinary superphosphate.
$\frac{1}{2}$,, sulphate of ammonia.
,, 14.—No manure.
,, 15.—2 cwt. ordinary superphosphate.
1 ,, nitrate of soda (applied in spring).
,, 16.—1 ,, ordinary superphosphate.
$\frac{1}{2}$,, nitrate of soda (applied in spring).
,. 17.—No manure.
,, 18.—2 cwt. ordinary superphosphate.
$1\frac{1}{2}$,, sulphate of ammonia.
,, 19.—2 ,, ordinary superphosphate.
$1\frac{1}{2}$,, nitrate of soda (applied in spring).
,, 20.—No manure.
,, 21.—2 cwt. ordinary superphosphate.
$\frac{2}{3}$,, potash sulphate.
1 ,, sulphate of ammonia.
,, 22.—2 ,, ordinary superphosphate.
$\frac{2}{3}$,, potash sulphate.
1 ,, nitrate of soda (applied in spring).
,, 23—No manure.
,, 24.—1 cwt. ordinary superphosphate.
$\frac{1}{3}$,, potash sulphate.
$\frac{1}{2}$,, nitrate of soda (applied in spring).

Set O.

Manures Used per Acre.

Plot 1.—1 cwt. ordinary superphosphate.
,, 2.—No manure.
,, 3.—2 cwt. ordinary superphosphate.
,, 4.—3 ,, ordinary superphosphate.
,, 5.—No manure.
,, 6.—2 cwt. Thomas phosphate.
,, 7.—2 ,, bonedust.
,, 8.—No manure.
,, 9.—2 cwt. ordinary superphosphate.
$\frac{2}{3}$,, potash chloride.
,, 10.—2 ,, Thomas phosphate.
$\frac{2}{3}$,, potash chloride.
,, 11.—No manure.
,, 12.—2 cwt. ordinary superphosphate.
1 ,, sulphate of ammonia.
,, 13.—2 ,, Thomas phosphate.
1 ,, nitrate of soda (applied in spring).
,, 14.—No manure.

Plot 15.—2 cwt. ordinary superphosphate.
1 ,, nitrate of soda (applied in spring).
,, 16.—1 ,, sulphate of ammonia.
⅔ ,, potash chloride.
,, 17.—No manure.
,, 18.—1 cwt. nitrate of soda (applied in spring).
⅔ ,, potash of chloride.
,, 19.—2 ,, ordinary supherphosphate.
1 ,, sulphate of ammonia.
⅔ ,, potash chloride.
,, 20.—No manure.
,, 21.—2 cwt. ordinary superphosphate.
1 ,, nitrate of soda (applied in spring).
⅔ ,, potash chloride.
,, 22.—2 ,, Thomas phosphate.
⅔ ,, potash chloride.
1 ,, nitrate of soda (applied in spring).
,, 23.—No manure.
,, 24.—3 cwt. ordinary superphosphate.
1 ,, potash chloride.
1½ ,, nitrate of soda (applied in spring).

Set O2.

Manures Used per Acre.

Plot 1.—1 cwt. ordinary superphosphate.
,, 2.—No manure.
,, 3.—2 cwt. ordinary superphosphate.
,, 4.—3 ,, ordinary superphosphate
,, 5.—No manure.
,, 6.—2 cwt. Thomas phosphate.
,, 7.—2 ,, bonedust.
,, 8.—No manure.
,, 9.—2 cwt. ordinary superphosphate.
⅔ ,, potash sulphate.
,, 10.—2 ,, Thomas phosphate.
⅔ ,, potash sulphate.
,, 11.—No manure.
,, 12.—2 cwt. ordinary superphosphate.
1 ,, sulphate of ammonia.
,, 13.—2 ,, Thomas phosphate.
1 ,, nitrate of soda (applied in spring).
,, 14.—No manure.
,, 15.—2 cwt. ordinary superphosphate.
1 ,, nitrate of soda (applied in spring).
,, 16.—1 ,, sulphate of ammonia.
⅔ ,, potash sulphate.
,, 17.—No manure.
,, 18.—1 cwt. nitrate of soda (applied in spring).
⅔ ,, potash sulphate.

Plot 19.—2 cwt. ordinary superphosphate.
1 ,, sulphate of ammonia.
⅔ ,, potash sulphate.
,, 20.—No manure.
,, 21.—2 cwt. ordinary superphosphate.
1 ,, nitrate of soda (applied in spring).
⅔ ,, potash sulphate.
,, 22.—2 ,, Thomas phosphate.
⅔ ,, potash sulphate.
1 ,, nitrate of soda (applied in spring).
,, 23.—No manure.
,, 24.—3 cwt. ordinary superphosphate.
1 ,, potash sulphate.
1½ ,, nitrate of soda (applied in spring).

The Farmers' Views Given First Consideration.

The first glance at the manure combinations will possibly give the idea that the experiments have not been conceived in a scientific spirit. It will be observed that comparisons have been made not between pounds of different plant foods, or different forms of the same plant food, but between hundredweights of different manures. There is, I know, no guarantee that these manures will not show variability of composition, and this variability may result in returns under altered conditions of composition of a quite contradictory kind; but against this there is the experience of a certain permanency of character from year to year in the composition of the principal fertilizers obtainable on the market, and any marked variation in character would immediately come under the notice of this laboratory and receive attention. The manures used in the experiments have been analysed and their percentages of plant food determined. They agree, for the most part, in composition with samples sold on the market, and may be regarded as fairly representative of the bulk of similar manures offering, and where the farmer buys, he is supposed to make his comparisons of the relative values of different fertilizers on the analysis figures supplied in this report. The system adopted in these tests of comparing the returns obtained from hundredweights of different manures instead of from pounds of different plant foods, has been used because it follows the language, and is not above the understanding of the farmer. In a few years it may be possible to make results intelligible by discussing them as the product of pounds of phosphoric acid, nitrogen and potash, for the present I consider it is a little premature to adopt this method. The analytical results allow of comparisons being made in such terms, however, where considered desirable.

Composition of Manures Used.

The manures used showed the following compositions:—

Superphosphate.

Phosphoric Acid.	Water soluble	19·19%
,,	Citrate soluble	1·62
	Total	20·81%

Thomas Phosphate.

Phosphoric Acid.	Citrate soluble	11·83%
,,	Insoluble	5·41
	Total	17·24%

Bonedust.

Total Phosphoric Acid	20·35%
Nitrogen	3·87%

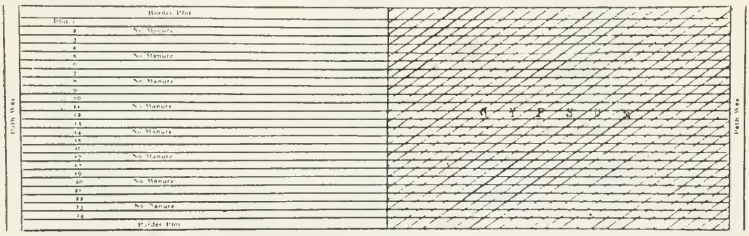
Mechanical Condition of Bonedust.

Coarse	62·53%
Fine	37·47%

Nitrate of soda	14·81%N
Sulphate of ammonia	20·66%N
Potash sulphate	52·77%K_2O
Potash chloride	61·94%K_2O

The Use of Gypsum.

In addition to the manures used in the three sets, gypsum was included in a limited number of fields. The system of application will be explained by referring to the following plan :—



396 feet long (6 chains). Total area $1\frac{3}{10}$ acres.
Each plot is $\frac{1}{20}$ of an acre.

It will be observed that one-half of the field received the application of gypsum in addition to the manures of the particular set. In the other half of the field the manures of the set only were applied. The intention was to harvest each half of each plot separately and compare the returns of the gypsum and non-gypsum ends. To secure results of reliability assumed uniformity of conditions throughout. It was found, however, that the excessively wet season experienced in the parts in which these special fields had been established, had, in nearly all instances, resulted in one end of the field being affected to a greater extent than the other, and the tests had to be abandoned.

From appearances there were only a few instances in which indications of an operative effect of gypsum were present, but in the absence of sufficiently numerous and reliable returns no conclusions one way or the other can be drawn.

The Object Sought in the Experiments.

The scope of the field of inquiry covered by the experiments is a wide one, and answers have been sought, not only as to soil deficiencies, but as to particular forms of plant food, and combinations best meeting these deficiencies. An examination of the manure lists of the different sets will disclose the attempted solution of the following questions :—

1. The effects of applications of phosphoric acid alone.
2. Of phosphoric acid and potash.
3. Of phosphoric acid and nitrogen.
4. Of phosphoric acid, nitrogen and potash.
5. The comparative effects of sulphate of ammonia and nitrate of soda in combination with phosphoric acid alone, as well as in combination with phosphoric acid and potash.
6. The effect of light, heavy and medium additions of a nitrogenous manure to medium dressings of superphosphate.
7. The effect of light additions of a nitrogenous manure to light applications of a superphosphate.
8. The comparative effect of equal quantities of the three forms of phosphatic manure, viz., superphosphate, Thomas phosphate and bonedust.
9. The comparative effect of equal quantities of Thomas phosphate and superphosphate, both alone, and in combination with the two forms of nitrogen and the two forms of potash.
10. The effect of equal quantities of sulphate of ammonia with the sulphate and chloride of potash.
11. The effect of equal quantities of the chloride of potash with nitrate of soda and sulphate of ammonia.

The Results of the Year's Experiments.

There were more than 70 fields established last year in Southern Victoria, but owing to the loss of many crops through caterpillars and heavy and continuous rains during harvesting, results of reliability were finally available from 50 fields only. Out of the 50 fields the manures of the G sets were applied on 23, those of the O on 14, and those of O2 on 13. As the manurial applications of the three sets agreed in certain respects—namely, with regard to questions dealing principally with the attempt to determine soil deficiencies rather than to solve the numerous other problems referred to—it has been

MARKED EFFECT OF PHOSPHATIC MANURING AT BURWOOD

The adjoining plots are unmanured

EFFECT OF PHOSPHATIC MANURING ON THE FARMS OF PARKER, FISH AND WYLIE OF COLAC

The small sheaves are from unmanured plots

possible to secure the average returns of the full number of 50 fields in the case of all plots dealing with this aspect of the subject. These returns are given in table A, on page 593.

The Results of Table A Discussed.

The results are a very fine confirmation of the returns obtained in the tests of the preceding year. There appears in the results of both years a very close agreement, both in the average returns of the unmanured plots as well as in the increased yields following applications of a phosphatic manure, and the combination of a phosphatic with a nitrogenous and potassic. This fact is apparent in comparing the results in this respect of the two years' experiments.

	Yield of Unmanured plots in tons.	Increased Yields Produced By			
		1 cwt. of Superphosphate per acre.	2 cwt. of Superphosphate per acre.	2 cwt. of Superphosphate. 1 cwt. of Sulphate of ammonia.	2 cwt. of Super. 1 cwt. of Sulphate of ammonia. ⅔ cwt. of Potash chloride.
Results obtained 1902-3 ..	1·66	·52	·66	1·23	1·30
Results obtained 1903-4 ..	1·46	·57	·80	1·20	1·23

The effective action of applications of phosphoric acid on the soils of the South, evident in the returns of table A, might have been expected from past experience with Northern lands, but the extent of its operative effect has even exceeded expectations. Taking the average of 50 fields we find as the result of the use of 1 and 2 cwts. of superphosphate, respectively, increased returns of more than half a ton of hay in the first case and as much as four-fifths of a ton in the second instance. In certain cases such increases have been largely exceeded, and have resulted in yields, on soils of a certain class, of quite an extraordinary nature. The illustrations showing the produce from certain plots will help to convey some idea of the general effect produced by phosphatic applications on soil productivity, as well as a few extreme cases of its operative action on certain soils showing apparently a special deficiency in this plant food.

As striking instances of what differences, comparatively speaking, small quantities of phosphatic fertilizers may effect on certain soils, the returns of Messrs. Cuthbert (of Burwood), and Johnson (of Wickliffe), and Parker and Fish (of Colac) may be referred to. At Burwood, an application of 2 cwt. of superphosphate per acre raised the yield of hay from considerably less than half a ton to 2·17 tons. At Wickliffe, where a like quantity of superphosphate was used, a yield of 3½ tons resulted, compared with a return of less than 1½ tons in the unmanured portion. At Old Yeo, near Colac, results of an equally striking nature were obtained.

It will, of course, not be expected that all soils in Southern Victoria will show a similar response to such applications. In the Western district, specially, there are large areas where the natural fertility of the soil is of such a high standard that the application of fertilizers could not be recommended as a profitable procedure.

The Preferable Form of Phosphatic Applications.

Tests to determine the particular form of a phosphatic manure giving the best results on the soils of the South were not included in the whole of the 50 fields, but only in 27 of that number. The results of these tests, as well as all others included in the experiments of the year, are given in tables B and C which follow.

A discussion of these results will constitute part of the work of this paper.

(*To be Continued.*)

SHOWING EFFECT OF 1 AND 2 CWT. OF SUPERPHOSPHATE PER ACRE—GEELONG DISTRICT

Centre Stook in each case unmanured

TABLE A.

Results obtained from the Manuring of Hay Crops on 50 Experimental Fields in Southern Victoria.

	Manures Used per Acre with Yields in Tons.								
	1 cwt. Ordy. Super.	2 cwt. Ordy. Super.	3 cwt. Ordy. Super.	2 cwt. Ordy. Super. 2 cwt. Potash Sulphate.	2 cwt Ordy. Super. 1 cwt. Sulphate Ammonia.	2 cwt. Ordy. Super. 1 cwt. Nitrate Soda (applied in Spring)	2 cwt. Ordy. Super. 1 cwt. Sulphate Ammonia. 1 cwt. Potash Chloride.	2 cwt. Ordy. Super. 1 cwt. Nit. Soda (applied Spring) 1 cwt. Potash Chloride.	Average of the Unmanured Plots.
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Madden Bros., Yambuk ..	2·62	2·90	2·41	2·84	2·95	2·87	2·94	3·37	1·44
P. Madden ,,	1·53	1·75	1·23	1·69	2·24	2·18	2·78	2·79	1·16
R. Lewis ,,	2·08	2·22	2·60	2·42	2·91	2·50	2·86	2·45	1·71
J. Dalton ,,	1·84	2·40	1·90	1·87	2·56	2·21	2·06	2·06	1·48
D. O'Shannassey ,,	·35	·44	·40	·38	·57	1·14	·75	1·09	·37
D. H. Johnston, Wickliffe	3·08	3·51	3·56	3·70	4·17	4·20	4·58	4·21	1·41
Rooney Bros, Warrnamb'l	2·26	2·57	2·60	2·56	3·05	2·76	3·01	3·42	2·37
Jas. Rae, Naringal ..	1·58	2·22	2·68	2·44	2·99	2·51	2·76	2·68	1·40
J. Killeen, Mepunga ..	1·43	1·36	1·40	1·75	1·89	2·35	1·81	2·08	1·28
H. T. Allwood, Mepunga	1·48	1·45	1·53	1·48	1·70	2·00	1·81	2·09	1·30
J. Stanhope, Mepunga ..	1·76	2·18	1·91	2·21	2·64	2·55	2·84	2·51	1·43
J. Trigg, Senr., Mepunga	1·93	2·55	1·80	2·31	2·73	2·56	2·72	2·34	1·29
D. Rae, Cudgee.. ..	2·88	2·34	2·81	3·14	3·35	3·91	3·73	3·92	2·61
W. Taylor, Allansford ..	3·61	4·46	4·14	3·68	3·44	3·84	3·88	3·28	2·67
T. Drake ,,	1·90	2·10	2·45	1·90	2·62	2·76	2·96	2·88	1·27
G. White ,,	1·27	1·50	1·64	1·67	1·47	1·84	1·61	1·88	1·12
C. J. Taylor, ,,	·92	·82	·71	1·45	2·00	1·76	1·56	1·43	1·01
W. Wheildon, Longwarry	1·10	1·17	1·05	1·07	1·75	1·82	1·68	1·58	·63
D. Kett ,,	1·96	1·78	1·58	1·58	2·03	1·73	2·44	2·37	1·36
W. Baird ,,	1·67	1·78	1·81	2·02	2·52	2·40	2·39	2·27	1·47
T. Maisey, Longwarry ..	·75	·90	1·06	1·17	1·58	1·56	1·50	1·28	·37
A. Williams, Garfield ..	2·34	2·57	2·75	2·28	2·90	2·69	2·69	2·27	1·50
W. McSkimming, Bunyip	3·35	3·64	3·84	4·55	4·30	3·31	5·50	4·03	2·79
T. Stafford, ,,	·98	1·07	1·06	·93	1·40	1·45	1·53	1·02	·68
W. Casement ,,	1·64	2·12	1·99	1·46	2·10	1·46	1·82	1·57	·69
W. Forsyth ,,	·75	1·00	1·12	1·19	1·74	1·86	1·72	·88	·64
E. S Hill, Bunyip South..	2·02	2·27	2·36	1·98	2·50	1·94	2·21	1·54	1·06
J. Jenkins, Koo-Wee-Rup	2·12	3·19	2·60	3·17	3·36	3·01	3·26	2·94	1·62
P. McGrath, Loch ..	1·66	1·58	1·64	1·89	2·23	1·99	2·15	2·15	1·30
J. Collins, Irrewarra ..	1·92	3·29	3·25	3·62	3·48	3·01	3·33	3·68	·94
Jno. Wylie, Turkeith ..	2·68	2·65	3·01	3·10	3·48	3·25	3·83	3·11	1·63
Jno. Wylie ,, ..	2·75	3·25	3·53	3·20	3·47	3·40	3·73	3.23	1·48
W. T. Fish, Yeo, Colac ..	3·41	3·57	3·77	4·15	4·20	4·21	4·13	3·68	1·55
W. Parker, Yeo, Colac ..	2·53	2·39	1·98	2·90	3·34	3·06	2·91	2·89	·64
W. Muhlebach, Batesford	2·33	2·62	2·56	2·61	2·67	2·95	1·98	3·15	2·14
W. Scott, Connewarre ..	1·40	1·66	1·38	1·31	2·00	2·06	1·98	2·14	1·23
W. Thomas, Herne Hill ..	2·41	2·89	3·03	2·77	2·87	2·66	3·37	2·82	2·30
W. E. Sutterby, Herne Hill	2·56	2·56	2·81	2·78	2·26	3·03	3·13	3·14	1·78
C. J. Tadgell, Moolap ..	2·83	2·63	2·69	2·66	2·37	3·04	2·78	3·21	2·53
J. Larkin, ,,	1·44	1·37	1·94	1·64	2·01	1·83	2·06	1·68	·89
R. H. Sutterby ,,	2·04	2·09	1·79	1·98	2·38	2·44	2·27	2·71	2·21
R. Blythe, Barwon Heads	1·72	2·12	2·21	1·91	2·17	2·18	2·00	1·85	·94
W. O'Brien, Cowies Creek	1·56	1·65	1·60	1·50	3·24	2·26	2·62	2·60	·97
J. Jinks, Curlewis ..	1·79	2·04	2·76	1·66	2·86	2·87	3·13	3·10	1·69
Paech Bros , Germanton..	1·47	1·18	1·34	1·57	1·96	2·10	2·07	2·03	1·29
S. McCann, Ceres ..	1·77	2·29	2·27	2·75	2·60	2·25	2·31	2·34	1·57
J. Robb, Geelong West ..	3·25	3·61	3·61	3·24	3·62	3·36	3·57	3·75	2·75
J. McCurdy, Geelong ..	1·85	2·60	2·93	2·51	2·72	1·92	3·18	2·74	1·17
T. A. Grant, Toolern ..	4·00	4·75	4·80	5·32	5·00	4·93	4·71	4·96	3·50
Jas. Cuthbert, Burwood ..	1·53	2·17	2·19	1·70	2·18	1·53	2·30	1·81	·42
Average yield of the 50 fields	2·03	2·26	2·28	2·31	2·66	2·55	2·69	2·58	1·46
Gain due to manures ..	·57	·80	·82	·85	1·20	1·09	1·23	1·12	

TABLE

Returns from Experimental Hay Plots where the

	Manures Used per Acre								
	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt. Ordinary Superphospate.	No Manure.	2 cwt. Thomas Phosphate.	2 cwt. Bonedust.	No Manure.	2 cwt. Ordinary Superphosphate. ½ cwt. Potash Chloride.
	1	2	3	4	5	6	7	8	9
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
R. Lewis, Yambuk	2·08	1·75	2·22	2·60	1·76	2·04	2·00	1·82	2·42
* J. Dalton ,, ...	1·84	1·74	2·40	1·90	1·30	1·65	1·90	1·51	1·87
* D. O'Shannassey, Yambuk ..	·35	·33	·44	·40	·33	·42	·47	·28	·38
D. H. Johnston, Wickliffe ..	3·08	·84	3·51	3·56	1·38	3·31	3·48	1·44	3·70
* Rooney Bros., Warrnambool ..	2·26	2·26	2·57	2·60	2·37	2·42	2·56	2·35	2·56
J. Killeen, Mepunga.. ..	1·43	1·23	1·36	1·40	1·05	2·02	1·67	1·43	1·75
Jas. Rae, Naringal	1·58	1·52	2·22	2·68	1·40	1·96	2·36	1·40	2·44
H. T. Allwood, Mepunga ..	1·78	1·34	1·45	1·53	1·23	1·20	·93	·90	1·48
J. Stanhope, Mepunga ..	1·76	1·34	2·18	1·91	1·52	1·87	2·08	1·80	2·21
J. Trigg, Senr. ,, ...	1·93	1·35	2·55	1·80	1·70	2·03	2·48	1·04	2·31
D. Rae, Cudgee	2·88	2·50	2·34	2·81	2·20	2·80	2·54	2·24	3·14
W. Taylor, Allansford ..	3·61	2·80	4·46	4·14	2·80	3·00	3·54	2·70	3·68
* T. Drake, ,, ..	1·90	1·41	2·10	2·45	1·38	1·82	2·17	1·21	1·90
* G. White ,, ..	1·27	1·14	1·50	1·64	1·00	1·80	1·52	1·47	1·67
* C. J. Taylor ,, ..	·92	·78	·82	·71	1·13	1·53	1·47	1·14	1·45
W. Wheildon, Longwarry ..	1·10	·84	1·17	1·05	·75	·99	1·27	·79	1·07
* D. Kett, Longwarry	1·96	1·67	1·78	1·58	1·44	1·32	1·40	1·22	1·58
* W. Baird ,, ...	1·67	1·19	1·78	1·81	1·52	1·73	2·08	1·65	2·02
* T. Maisey ,, ...	·75	·33	·90	1·06	·41	1·03	1·16	·35	1·17
A. Williams, Garfield ..	2·34	1·94	2·57	2·75	1·72	2·39	2·43	1·41	2·28
* W. McSkimming, Bunyip ..	3·35	2·75	3·64	3·84	2·90	3·50	4·07	2·90	4·55
T. Stafford, Bunyip	·98	·70	1·07	1·06	·63	·87	·92	·62	·93
* W. Casement, ,, ...	1·64	·82	2·12	1·99	·78	1·62	1·32	·69	1·46
W. Forsyth, ,, ...	·75	·65	1·00	1·12	·72	·82	1·12	·64	1·19
* E. S. Hill, ,, South ..	2·02	1·33	2·27	2·36	1·14	1·67	1·81	1·14	1·98
J. Jenkins, Koo-Wee-Rup ..	2·12	1·82	3·19	2·60	1·65	2·27	2·58	1·70	3·17
* P. McGrath, Loch	1·66	1·29	1·58	1·64	1·25	1·50	1·65	1·33	1·89
Average of the 27 fields ..	1·87	1·39	2·04	2·03	1·38	1·83	1·96	1·38	2·08
Gains due to manures ..	·48		·65	·65		·45	·58		·70

* Potash applied in form of Potash Sulphate.

B.

anure Combinations of the O and O^2 Sets have been used.

WITH YIELDS IN TONS.

2 cwt. Thomas Phosphate. ⅔ cwt. Potash Chloride.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Sulphate Ammonia.	2 cwt. Thomas Phosphate. 1 cwt. Nitrate Soda (applied Spring).	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring).	1 cwt Sulphate Ammonia. ⅔ cwt. Potash Chloride.	No Manure.	1 cwt. Nitrate Soda (applied Spring). ⅔ cwt. Potash Chloride.	2 cwt. Ordinary Superphosphate. 1 cwt. Sulphate of Ammonia. ⅔ cwt. Potash Chloride.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring). ⅔ cwt. Potash Chloride.	2 cwt. Thomas Phosphate. ⅔ cwt. Potash Chloride. 1 cwt. Nitrate Soda (applied Spring).	No Manure	3 cwt. Ordinary Superphosphate. 1 cwt. Potash Chloride. 1½ cwt. Nitrate Soda (applied Spring).
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
2·01	1·88	2·91	2·32	1·56	2·50	1·49	1·63	1·99	2·86	1·63	2·45	2·55	1·67	2·61
1·69	1·37	2·56	2·30	1·47	2·21	1·75	1·59	1.92	2·06	1·50	2·06	2·21	1·32	2·28
·35	·37	·57	1·00	·42	1·14	·53	·44	·72	·75	·40	1·09	1·06	·44	1·16
3·17	1·44	4·17	2·85	1·37	4·20	1·82	1·79	1·67	4·58	1·48	4·21	3·56	1·55	4·13
2·37	2·42	3·05	2·78	2·28	2·76	2·50	2·42	3·01	3·01	2·57	3·42	3·26	2·30	2·92
1·43	1·37	1·89	2·18	1·40	2·35	1·88	1·33	1·65	1·81	1·20	2·08	1·81	1·28	2·14
2·04	1·40	2·99	1·75	1·38	2·51	1·96	1·36	1·60	2·76	1·39	2·68	2·36	1·42	2·72
1·67	1·40	1·70	1·77	1·43	2·00	1·65	1·60	1·72	1·81	1·20	2·09	1·91	1·37	2·25
1·51	1·64	2·64	2·21	1·41	2·55	1·06	1·00	1·50	2·84	1·43	2·51	2·30	1·30	3·16
2·13	1·00	2·73	2·26	1·30	2·56	1·64	1·45	1·45	2·72	1·04	2·34	2·16	1·45	3·43
3·04	2·18	3·35	3·50	2·12	3·91	3·00	2·50	2·00	3·73	2·71	3·92	3·74	2·43	4·43
3·64	3·28	3·44	3·56	2·62	3·84	3·39	2·82	3·10	3·88	2·40	3·28	3·10	2·00	3·10
2·03	1·14	2·62	2·37	1·27	2·76	·62	1·26	1·26	2·96	1·26	2·88	2·60	1·25	2·92
1·47	1·17	1·47	1·60	·88	1·84	1·30	1·13	1·34	1·61	1·08	1·88	1·82	1·16	2·27
1·63	1·22	2·00	2·05	1·17	1·76	1·44	·80	1·73	1·56	1·02	1·43	1·60	·87	1·86
1·00	·02	1·75	1·36	·65	1·82	1·12	·67	·65	1·68	·69	1·58	1·49	·69	1·94
1·45	1·09	2·03	1·93	1·37	1·73	1·72	1·25	1·73	2·44	1·30	2·37	2·28	1·58	2·83
1·62	1·57	2·52	2·36	1·50	2·40	1·86	1·53	1·68	2·39	1·45	2·27	2·29	1·39	2·75
1·17	·37	1·58	1·16	·35	1·56	·51	·40	·50	1·50	·39	1·28	1·24	·39	1·51
2·39	1·74	2·90	2·75	1·63	2·69	2·05	1·46	1·80	2·69	1·50	2·27	2·31	1·62	2·69
4·13	2·93	4·30	3·25	2·66	3·31	3·21	2·66	2·50	5·50	2·66	4·03	4·27	2·90	3·75
·95	·44	1·40	1·40	·75	1·45	1·27	·76	·89	1·53	·79	1·02	1·12	·82	1·59
1·28	·64	2·10	1·78	·71	1·46	·80	·66	1·01	1·82	·60	1·57	1·51	·64	1·73
·83	·72	1·74	1·33	·59	1·86	1·12	·60	·92	1·72	·64	·88	·97	·62	·95
1·83	1·07	2·50	1·67	1·12	1·94	1·34	1·00	1·29	2·21	·87	1·54	1·57	·81	2·32
2·35	1·30	3·36	2·40	1·37	3·01	2·32	1·67	1·55	3·26	1·66	2·94	2·91	1·80	3·55
1·66	1·28	2·23	1·68	1·33	1·99	1·88	1·41	1·62	2·15	1·34	2·15	1·62	1·24	1·76
1·88	1·34	2·46	2·13	1·33	2·37	1·67	1·37	1·58	2·51	1·33	2·30	2·20	1·34	2·55
·54		1·12	·80		1·04	.30		·21	1·18		·97	·86		1·21

TABLE

Returns per Acre from Experimental Hay Plots where th

Manures given per acre.	Manures Used per Acre								
	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Sulphate.	1 cwt. Ordinary Superphosphate. ⅓ cwt. Potash Sulphate.	No Manure.	⅔ cwt. Potash Sulphate. 1 cwt. Sulphate of Ammonia.
No. of Plots	1	2	3	4	5	6	7	8	9
Yield per acre:— ..	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
J. Collins, Irrewarra	1·92	·96	3·29	3·25	1·03	3·62	2·85	1·10	1·37
Jno. Wylie, Turkeith	2·68	1·89	2·65	3·01	1·63	3·10	2·87	1·74	1·97
Jno. Wylie, Turkeith	2·75	1·69	3·25	3·53	1·57	3·20	2·70	1·69	1·71
W. T. Fish, Yeo	3·41	1·40	3·57	3·77	1·50	4·15	3·07	1·71	1·74
W. Parker, Yeo	2·53	·75	2·39	1·98	·53	2·90	1·50	·60	1·04
W. Muhlebach, Batesford ..	2·33	1·97	2·62	2·56	2·10	2·61	2·39	2·03	2·11
W. Scott, Connewarre	1·40	1·31	1·66	1·38	1·16	1·31	1·35	1·18	1·53
W. Thomas, Herne Hill ..	2·41	2·22	2·89	3·03	2·22	2·77	2·70	1·94	2·14
W. E. Sutterby, Herne Hill ..	2·56	1·75	2·56	2·81	1·42	2·78	2·58	1·82	1·79
C. J. Tadgell, Moolap	2·83	2·70	2·63	2·69	2·15	2·66	3·08	2·62	2·47
J. Larkin, Moolap	1·44	·87	1·37	1·94	·83	1·64	1·64	1·11	1·45
R. H. Sutterby, Moolap ..	2·04	1·82	2·09	1·79	2·09	1·98	2·10	1·95	1·97
R. Blyth, Barwon Heads ..	1·72	·75	2·12	2·21	·96	1·91	1·77	1·03	·90
W. O'Brien, Cowies Creek ..	1·56	·90	1·65	1·60	·77	1·50	1·17	·79	1·22
J. Jinks, Curlewis	1·79	1·10	2·04	2·76	1·51	1·66	2·53	1·91	2·19
Paech Bros., Germanton ..	1·47	·95	1·18	1·34	1·05	1·57	1·53	1·65	2·03
S. McCann, Ceres	1·77	1·62	2·29	2·27	1·71	2·75	2·46	1·74	1·55
J. Robb, Geelong West ..	3·25	3·01	3·61	3·61	2·80	3·24	3·27	3·01	3·55
J. McCurdy, Geelong	1·85	1·37	2·60	2·93	1·10	2·51	1·92	·70	1·14
Jas. Cuthbert, Burwood ..	1·53	·66	2·17	2·19	·47	1·70	1·53	·37	·56
T. A. Grant, Toolern	4·00	3·43	4·75	4·80	3·50	5·32	4·50	3·77	3·90
Madden Bros, Yambuk ..	2·62	1·54	2·90	2·41	1·41	2·84	2·04	1·47	1·96
P. Madden	1·53	1·41	1·75	1·23	1·35	1·69	1·91	1·03	1·26
Average of the 23 Fields ..	2·23	1·56	2·52	2·56	1·51	2·58	2·32	1·60	1·80
Gains due to Manures ..	·67	—	·96	1·05	—	1·07	·72	—	·20

C.

anure Combinations of the G Sets have been used.

WITH YIELDS IN TONS.

...½ cwt. Sulphate of Ammonia.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Sulphate of Ammonia.	1 cwt. Ordinary Superphosphate. ½ cwt. Sulphate of Ammonia.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring).	1 cwt. Ordinary Superphosphate. ½ cwt. Nitrate Soda (applied Spring).	No Manure.	2 cwt. Ordinary Superphosphate. 1½ cwt. Sulphate of Ammonia.	2 cwt. Ordinary Superphosphate. 1½ cwt. Nitrate Soda (applied Spring).	No Manure	2 cwt. Ordinary Superphosphate. ⅝ cwt. Potash Sulphate. 1 cwt. Sulphate of Ammonia.	2 cwt. Ordinary Superphosphate. ⅝ cwt Potash Sulphate. 1 cwt. Nitrate Soda (applied Spring).	No Manure.	1 cwt. Ordinary Superphosphate. ⅝ cwt. Potash Sulphate. ½ cwt. Nitrate Soda (applied Spring).
0	11	12	13	14	15	16	17	18	19	20	21	22	23	24
ons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
·33	1·10	3·48	2·62	·90	3·01	2·16	·78	3·13	2·21	·81	3·33	3·68	·83	2·51
·87	·88	3·48	3·29	1·74	3·25	2·91	1·87	3·69	3·41	2·57	3·83	3·11	1·76	2·98
·70	1·50	3·47	2·65	1·39	3·40	2·68	1·39	3·71	3·34	1·33	3·73	3·23	1·33	2·94
·69	1·74	4·20	3·27	1·62	4·21	3·36	1·58	4·37	4·00	1·49	4·13	3·68	1·41	3·34
·93	·64	3·34	2·82	·64	3·06	2·40	·71	2·89	3·19	·64	2·91	2·89	·64	1·88
·18	2·21	2·67	2·73	2·19	2·95	2·61	2·23	2·66	3·10	2·14	1·98	3·15	2·25	2·79
·87	1·39	2·00	1·78	1·20	2·06	1·70	1·39	2·38	2·14	1·18	1·98	2·14	1·07	1·62
·85	2·66	2·87	3·26	2·30	2·66	2·88	2·01	2·91	2·92	2·62	3·37	2·82	2·43	2·85
·83	1·64	2·26	2·82	1·96	3·03	2·87	1·82	3·00	2·88	2·06	3·13	3·14	1·81	2·89
·87	2·29	2·37	3·09	2·58	3·04	2·96	2·77	3·23	3·13	2·58	2·78	3·21	2·51	2·92
·25	1·08	2·01	1·63	·96	1·83	1·53	·88	1·93	1·60	·57	2·06	1·68	·85	1·68
·93	1·87	2·38	2·31	1·85	2·44	2·46	2·25	2·88	2·54	1·91	2·27	2·71	2·00	2·52
·99	1·04	2·17	1·82	1·11	2·18	2·03	·92	1·97	1·85	·85	2·00	1·85	·92	1·80
·23	1·12	3·24	2·39	·93	2·26	1·99	·99	1·79	3·41	1·11	2·62	2·60	1·30	2·30
2·25	2·46	2·86	2·76	1·72	2·87	2·65	1·60	2·87	2·80	2·33	3·13	3·10	·92	2·86
2·02	1·39	1·96	1·75	1·37	2.10	1·54	1·12	2·03	2·07	1·56	2·07	2·03	1·24	1·69
·67	1·76	2·60	2·44	1·54	2·25	1·95	1·39	2·42	2·35	1·38	2·31	2·34	1·48	2·06
2·58	3·09	3·62	3·65	2·76	3·36	3·37	2·52	3·30	3·71	2·45	3·57	3·75	2·41	3·69
1·10	·93	2·72	2·38	·98	1·92	2·12	1·40	3·77	2·60	1·38	3·18	2·74	1·51	2·57
·46	·48	2·18	1·31	·61	1·53	1·43	·10	1·66	2·12	·39	2·30	1·81	·32	1·44
3·50	3·05	5·00	4·48	3·73	4·93	4·83	3·70	5·05	4·26	3·58	4·71	4·96	3·25	4·69
1·63	1·51	2·95	2·35	1·41	2·87	2·63	1·57	3·30	3·41	1·25	2·94	3·37	1·48	2·88
1·83	1·08	2·24	2·02	1·07	2·18	1·90	1·09	3·21	2·71	1·31	2·78	2·79	·97	1·85
1·80	1·60	2·87	2·59	1·59	2·75	2·47	1·56	2·96	2·86	1·63	2·92	2·81	1·50	2·55
·20	—	1·27	1·00	—	1·16	·91	—	1·40	1·23	—	1·29	1·31	—	1·05

PRACTICAL SYLVICULTURE.

By A. Tatham.

By the heading of this article is understood the production and tending of forests from the seed stage until the time the trees are ready to be felled.

My remarks will, of course, be restricted chiefly to trees indigenous to Victoria; but occasion may arise, for the sake of illustration, for reference to exotic species.

The success of forestry naturally depends on the selection of species, but in Victoria it will be a matter of selection of varieties, as the native trees are, with few exceptions, all of the same family. Here a forester at once overcomes one of the most difficult questions to be dealt with in forming a forest. A mixture of species, therefore, need never trouble him in Victoria.

Before starting operations the question of future management has to be considered. Here again the indigenous species facilitate matters, the eucalyptus being a most obliging tree. All the varieties can be converted into sawn timber, most of them coppice, and with few exceptions, they make good fuel. Still there are many points to be considered, where the Australian forests must naturally be worked in accordance with sylvicultural systems to enable them to produce an annual yield without deterioration.

As some exotic plantations do exist in the State an effort will be made to formulate these remarks so as to cover their tending and formation.

Formation of Forests.

Forests can be formed in many different ways, according to what is required of them in after life. Natural regeneration and artificial formation are the two heads under which the different methods are classed.

Natural Regeneration.

Under this head we consider regeneration by seed, and by suckers and shoots. The eucalyptus family can be successfully raised in this manner.

Natural regeneration by seed is the formation of a new forest by the fall of seed from what are called *mother trees,* standing either on the area or adjoining it. In a primeval forest, when a tree falls from old age, an opening is made in the overhead cover or *leaf canopy,* seeds from the adjoining trees falling in the space made by this tree germinate; they grow up, and in turn produce seed. In this way forests are kept up by nature, but the process is a slow one, and thousands of seeds and seedlings are annually destroyed. Sylviculture here steps in to assist nature by accelerating the regeneration,

by the removal of the old trees as they become fit for economic purposes. As different forests and species growing therein required different treatment, so the management has had to be altered and the following systems introduced. But then again, these chiefly allude to mixed and not pure forests, though their adaptability to eucalyptus forests is permissible, and may in some cases be found advantageous.

The Selection System.—Under this method of treatment the regeneration goes on by the removal of old, diseased, or defective and large trees. The operation is not necessarily restricted to certain areas, but can go on all over the forest, advantage being taken of good seed years to remove the greatest number of these trees. Even where gaps have been caused, it is often found expedient in a few years to cut away some of the adjoining trees to enable the seedlings to obtain more light, but other than this no assistance is deemed necessary under this system. Where, however, a large area of forest is worked under this method, it is found best to divide it into blocks, one being cut over each year. This makes the cuttings take place at regular intervals in each block. In the Burmese teak forests the cuttings take place at intervals from 10 to 20 years. In Bengal the sal (*Shorea robusta*) forests are cut over every 30 or 40 years. The cuttings under this divisional system are naturally heavier than if a yearly cutting were undertaken.

This system is useful in protecting th · soil, as the leaf canopy is only interrupted in small patches, hence rain cannot disturb the surface soil and humus is encouraged. It is the best system to adopt in a forest that has not been systematically managed or has been severely over felled. It is also good for small forests. But it is a bad system where the demand for produce is greater than the supply ; and it has a tendency to withhold light from the young growing stock and draw them up somewhat sickly, where the species is light demanding

The Group System.—This, as its name indicates, is the cutting of the forest in patches, the resulting growth of seedlings comes up in these and forms groups. These patches, each succeeding year, are made wider, till the whole forest is gone over. The result is an uneven growth. This system is best adapted to mixed forests such as are found in Europe, but is least suitable to Australia as it is most expensive owing to its operations being scattered over a large area rendering supervision and transport of material difficult and costly.

The Compartment System.—The forest in this case is divided into compartments, each of which is cut over in turn, *i.e.*, all the trees on that area are felled ; the seedlings which will then spring up to take the place of the felled trees will all be of one age, or what is known as of *even growth* or *even aged*. This, it is hardly necessary to point out, greatly facilitates future working, more especially when the trees having arrived at maturity, the fellings can be on a wholesale scale if a demand exists for the produce, instead of picking a tree here and there as would be the case in an uneven aged forest.

This system of felling may prove the best to adopt in the Victorian forests, as owing to the indigenous species being chiefly one family, and the varieties being gregarious, their seeding will be general, and so go far to insure a quick and certain re-growth of seedlings. On the other hand, in mixed forests of deciduous trees, the seeding of the trees being irregular, it often takes two or three years before restocking of the forest can be considered certain. This gives rise to three separate fellings instead of one.

This system of working a forest has many advantages:—

It is a cheap one, as the work is concentrated, supervision is easy, and transport is lessened.

It insures a re-growth, dense and even, and by that means soon destroys all weeds and grasses, and prevents the erosion of the soil by rain or other causes.

It is the best system to adopt in a pure forest, such as Victorian forests may be called.

The Strip System.—This is but a modification of the compartment system. Instead of felling in large patches the forest is cut in belts or strips. The length of these need not be limited, but the breadth is of great importance, and must be entirely ruled by the contour of the ground and the climatic influence. It is more useful on hilly than plain country, its object being to prevent the destruction of young growth by wind storms. In cutting the strips care must be taken that they start at that portion of the forest which is opposite to the prevailing wind direction and at right angles to it. This system also prevents the erosion of soil that so frequently occurs on a steep face when denuded of timber. The great drawback to this method is the expense of the operation, the strips being long and narrow necessitate costly transport, though this may be to a certain extent simplified on steep ground. As has been said before, the object of all these systems is to encourage natural regeneration by seed, and also to utilise the forest produce to the best advantage of the forest itself.

Coppice.—We now take regeneration by shoots and suckers. Fortunately this method is one that has proved most successful in Victoria. In fact, it has been the saving of the State forests. Stool shoots or coppice shoots are the only ones we need consider, as the eucalyptus shows best results in this way. The shoots grow from either dormant buds, or from the callus at the edge of the cut, where a tree has been felled close to the ground.

The success of this system rests chiefly, in Victoria, on the age of the tree operated on. As a rule, as soon as a tree has reached its principal height growth, stool shoots are no longer produced, so care must be exercised to cut only those trees that are still growing in height. A diameter growth would be the simplest method to adopt. It would probably be found that trees 1 foot and under in diameter would coppice best, up to 2 feet many would miss or produce useless shoots, and over 2 feet few would produce any. To what age a forest

treated on the coppice system will live it is difficult to say, but it would be safe to predict a long life to most eucalyptus stools, judging by present conditions. It must be remembered that a diseased tree should be completely destroyed, as its stool will most probably produce diseased shoots. The method of cutting the stools is of vital importance.

FIG. 1

In the sketches, 1 and 4 are both bad; 1 will allow water to rest on the stool and eventually rot it; 4 is too high, and cut badly; 2 and 3 are both good, no water can rest on them. The stools should be cut as low as possible, so as to encourage the shoots to burst through the bark close to the ground, or, better still, under the surface, as these will then produce a root system of their own. The bark too is thinner near the ground. Where, as unfortunately is the case in most Victorian forests, insect pests, such as borers and grubs, abound, the stools should be covered with earth. The system is expensive, but well worth considering, as by doing so insects are prevented from laying their eggs in the stool.

The season when coppicing ought to be done will vary in different parts of the State but, as a rule, early winter to early spring is the best time. The sap has not then become very brisk, and the whole of the reserved material stored in the roots will go to force on the growth of the young stool shoots. In places where the danger from severe frost is great early spring is the best time; as frost often destroys the stool by causing the bark to separate from the wood. The same danger is to be feared if coppicing is done in hot, dry summer weather. Summer grown shoots are never so rapid in growth as spring grown, and autumn shoots are, as often as not, too tender to withstand frost.

Coppice with Standards.—This is a modification of the above, and in most of the Victorian forests it will be the best method to follow. The system is to allow a certain number of trees per acre to stand when the cutting operations are going on. These are left till the second or third cutting takes place, when they are felled, and are by then nearly or quite fully matured trees. The object in leaving these trees is not only to secure a supply of milling timber, but also to ensure a certain amount of regeneration by seed to fill any gaps that may be caused by the failure of any of the stools to reproduce shoots. This latter object is the only one required in Victoria, where the forests, owing to past overfelling, are often too thin and the trees very isolated. But it must be borne in mind that the greater the number of standards left, the less chance have the stool shoots of making good growth. They require light, and the shade thrown by the standards, which will increase as soon as their crowns are isolated, will tend either to suppress them or cause them to be drawn up thin

and useless. Coppice shoots always make greater growth in the earlier period of their life than in the later. A coppice shoot in Victoria will often grow 12 to 15 feet in three years, but it may take 8 to 9 years to grow another 12 or 15.

It may be found that a thinning of the shoots will be required, but, as a rule, this need not be done where the stools stand close together, for although some dozen shoots start, at the end of three years or so it will be noticed that two or three have outstripped their fellows, and these only will form marketable produce, the rest will either die off or never grow more than a few feet. In selecting the standards to be left only saplings should be chosen, or coppice shoots from very young trees about 2 to 3 inches in diameter. Shoots from old stools are bad, and seldom form sound trees, and, as a rule, are indifferent seed bearers.

Suckers are the shoots from the roots. To encourage these the stump is grubbed, or cut below the ground; the roots, if near the surface, will throw up suckers. Peppermint and apple gum will both do this, but its expense is too great to entertain from a forest point of view. It is a system that might prove useful as a means of checking insect pests, but other than that there is no gain in Victoria by adopting it.

Pollard.—This is the oldest method of working a forest in Australia, and, strange to say, has not led to that amount of destruction one would anticipate. The method is to cut a tree at three or more feet above the ground, shoots then burst out along the stem that is left. Laziness was the cause of the adoption of this system in the past, no one ever thought of cutting a tree close to the ground. The resulting growth is similar to coppice, except that the shoots, being entirely dependent on the parent stem, are liable to be torn off by wind or other causes. Decay sets in early in the old stem, and the shoots suffer accordingly. This system is thoroughly bad, and should only be allowed where small produce, such as willows for basket making, is required, but even here this method is giving way to coppice.

Artificial Regeneration.

The former systems were all natural methods of forming a forest, and as such are the least expensive and most satisfactory, but attention will now be given to artificial methods. It must be borne in mind that this system is adopted only where trees do not already exist, or where it is desired to introduce a new species.

Direct Sowing.—Having selected the species most suitable for the area, we next consider the best method of sowing the seed. It would be useless, in most cases, to expect a good germination by sowing broadcast without considering the state of the soil. Should the land be infested with weeds it will require cleaning, as there is no surer method of courting failure than by allowing a crop of weeds to choke the seedlings; cultivation would be required here just as in a field crop. If the soil is hard it must be broken up, for unless it is

loosened no seedling can grow, moisture cannot penetrate, nor can the tender roots get deep enough down to withstand drought.

To take up an area of, say, a thousand acres and sow the seed broadcast would be an expensive method to adopt, and might prove unsuccessful, as the ground would have to be broken up, and even then the seedlings would stand a good chance of being choked. The best system to adopt in a case of this sort is to sow in strips. The land being broken up in lines some two to three feet wide, and four to six feet between the lines, the seed is sown in them. They can, at little expense, be kept free from injurious growth, and where the seed had failed, could be resown. If the lines are not too far apart the young trees will soon, by the meeting of their crowns, form a shade which will be beneficial to them by keeping down and eventually killing all weed growth between the lines, and prevent the sun destroying the humus caused by the decaying vegetable matter.

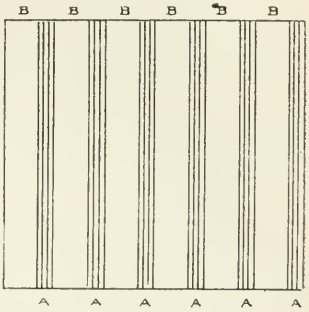


FIG. 2
STRIP SYSTEM
A.—Planted Area. B.—Unplanted Area.

In marking out the strips care will have to be exercised to run them in such a manner as to lessen as much as possible the chances of denudation by rain. On steep slopes the strips must be run horizontally and as level as possible; on flat land it is immaterial which way they run, but they ought always to be parallel to each other. Owing to the rapid growth of the eucalyptus this system is one that is likely to prove most successful in Victoria.

Sowing in Patches.—This is a cheaper method than the strip where the ground is much broken or of a rocky nature. The patches can be of any shape or size, according to the style of country, neither is there any regulation distance between them; in fact it is, where adopted, a case of plant where you can. Some patches may be only 3 feet x 2 feet or 4 feet x 4 feet, others run to 10 feet x 1 foot or 10 feet x 5 feet, again they may assume the shape of an irregular strip. The soil in every case will have to be broken up by some hand instrument, such as hoe, pick, or digging fork, and of course the resulting growth will be in groups.

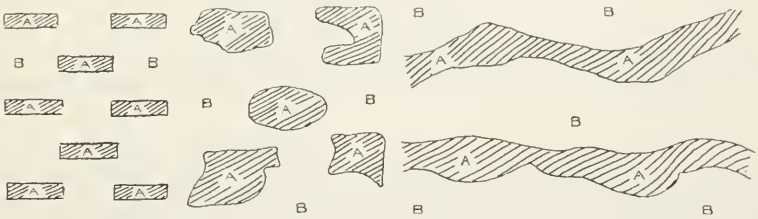


FIG 3—PATCH SYSTEM.
A.—Planted Area. B.—Unplanted Area.

In both these methods the seed after sowing is raked in or a slight covering of earth thrown over it. Sometimes it is necessary to adopt both systems in one area, as part of the land may be adaptable to strip sowing, and the rest so stony that the patch system has to be employed. There are numerous other methods of planting by seed, but in Victoria the two mentioned will suffice, the others being adaptable only to colder and wetter climates.

Planting.—The next system we have to consider is planting out the young trees. Undoubtedly this is the surest method of forming a forest, but, at the same time, the most expensive. The first step is the formation of the nursery where the seed is sown and the plants tended till they are ready to plant out.

The nursery site should be selected near water, but, at the same time, it must be level and well drained. The beds can be of any length, but should not exceed four feet in width, so as to enable the weeding and tending of the seedlings to be done without the necessity of treading on the bed. The tender young plants may, and often do, require shading from either hot sun or frost, so a temporary cover is needed, which should be so constructed as to exclude direct sun's rays and frost, but not interfere with a free current of air or sufficiency of light. The following illustrates a cheap system which has been found to answer the purpose well.

The construction of these shelters is cheap, being composed, as a rule, entirely of material found in the nursery area or close by. The posts, C, are rough saplings two inches in diameter, with a fork at the top end, and pointed at the lower to enable them to be driven into the ground. The roofing, B, is made of grass (thatch), ferns, or small branches with the leaves on. The roof slopes, to prevent drip on the seed beds; it comes to within 12 inches of the ground on the lower side, and slopes up to about five or six feet above ground on the upper. There is a space of about 12 to 15 inches between the two roofs at the top. The space between the beds is about two feet wide, and serves as a path. The gradual or total removal of the roofing is easily done, and the structure can be abandoned without loss when the nursery has been exhausted of plants. The chief points in favor of this system are utility, cheapness and simplicity, no nails being required, and only a little hay band where fibrous material is not at hand.

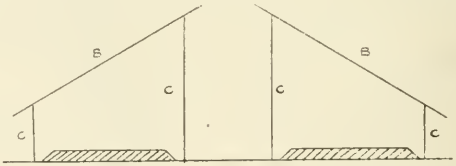


FIG. 4

B.—The Roof. C.—The Posts supporting the Roof.

Previous to sowing the seed, a nursery bed should be well watered, especially if the seed is fine. This not only settles the soil, but does away with the necessity of watering, as a rule, until the seed has germinated. As soon as the plants are showing great care must be taken to prevent over watering. The seedlings being tender and

very dense are liable to damp off. When the plants are big enough to handle they are transplanted into beds, about one to two inches apart, or into pots, until they are large enough to be planted in the area to be afforested.

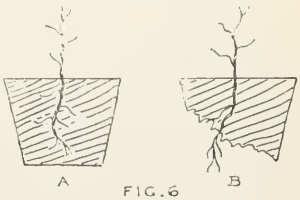
A nursery site should always be situated on, or as near as possible to the area to be planted, as long transport of young plants is expensive and injurious to them. Permanent nursery sites are a great mistake in sylviculture, and only in rare instances are they permissible, and in a country like Victoria, with its varying climates, they have little to recommend them, and except where water is scarce they should not be attempted.

Planting Out.—In some cases the plants are taken directly from the seed beds to the forest, there being no pricking out or previous transplanting done, but, unless plenty of room has been given the seedlings in the nursery, this is not a good system, as the plants will be found too tender to withstand the sudden exposure. Whatever system is adopted, great care must be taken to injure the roots as little as possible; and, where practicable, all plants should have a ball of earth round their roots, and as little time as possible should elapse between the time they are lifted from the nursery to their planting in the permanent position. When planting the roots must be placed in as natural a position as possible, keeping them straight down or slightly spread out, but on no account should they be bunched up or twisted.

There are many different methods of planting, and each in turn will be considered. It must be remembered we are only taking small plants, say 9 to 12 inches high.

Planting with Balls of Earth or from Pots.—A hole is usually cut, and this must be larger than the ball of earth attached to the plant. To ensure uniformity a special spade (Figure 5) is, as a rule, used, which enables the nurseryman to lift each plant with the same size ball of earth. The spade is circular, with one side open, it is also slightly conical. An excellent transplanter can be constructed from an ordinary one pound jam tin. When lifted the plant should look like A in the sketch, and not like B, in Fig. 6. The plant should be placed in the hole at the same depth as it is growing in the nursery, and great care should be taken to press the earth well all round the ball attached to the plant, for should water get in the hole and lie at its roots, it means failure.

FIG. 5

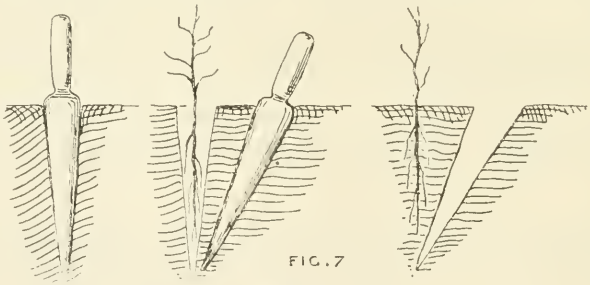


A FIG. 6 B

Open Root Planting, without Ball of Earth.—This is the simplest form of planting, but in Victoria is somewhat risky, unless the season be favorable, and yet with care a very small percentage of the plants should miss. Here again the best system to adopt is to plant in

holes. The hole is cut some time previous to planting, and is left open till just before the planting season when it is filled in, the top soil being first put back into the hole, the bottom soil being placed at the surface. The planter inserts his hand as deep as he thinks the plant demands into the loose soil and removes sufficient soil to accommodate the roots. When these are put in place, he presses the earth firmly round them and over the top. The operation only requires one man, or even a careful lad. In the case of large plants, say three to five feet high, the earth is only replaced at time of planting.

Planting with a Peg.—This is an excellent system where the ground is free from stones and not too tenacious. It is usually more adapted to hot dry climates, as it enables plants with long tap roots, as invariably is the case with dry climate plants, to get down to cool or moist soil. The usual method is to use a wooden peg, this is pushed into the ground, the plant placed in the resulting hole, the peg is then inserted again on one side of the plant, but at a little distance off, and after it is inserted it is pushed towards the plant, thereby causing the earth between it and the plant to be pressed into the space first made by the peg. The roots by this means are firmly pressed, and hold a fairly natural position. (Fig. 7.)



This is undoubtedly a cheap and quick method of planting, provided the soil is free, but it is only suited to small plants.

Notching.—This system is done in two ways. The first is to make a V shaped cut in the earth into which the young planted is inserted, and the earth filled in and pressed down, (Fig. 8). This V can be cut in two ways, with a notching axe or with a notching spade. The latter is the easier of the two instruments to work. It is shaped like an ordinary spade, but of somewhat stouter build, and at the top is about 2 inches thick. It is driven into the ground similarly to a spade, and worked backwards and forwards till the cut is sufficiently wide. The plant is placed in the cut, and earth pressed in on it. This system of planting is employed in France to a large extent, where small plants are put out.

The second method of notching is done with a spade. A cut is made in the ground and at right angles to it another cut is made,

forming the letter T, (Fig. 9). The spade is put in at the top of the T and the handle is depressed, the blade is thereby forced upward and in doing so opens the lower portion of the T, into this opening the plant is placed, the spade withdrawn and the earth pressed down with the feet of the operator. This method is employed in some of the English plantations. It is, however, not considered a satisfactory one; as, owing to the blade of the spade being in the way, the roots of the plant cannot be put down straight or in fact naturally, unless the plant is a very small one, consequently, when the earth is pressed down, as often as not the roots are turned upwards as shown in the sketch, (Fig. 10.) There is nothing so conducive to utter failure, or, at least, to a serious check to the growing plant, as this turning up of the roots, and in a climate like Victoria's the system ought not to be tried, as the hot summer will overtake the plant before it has time to take a deep enough root-hold.

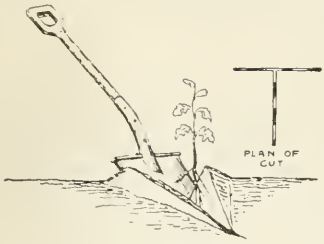


FIG. 9

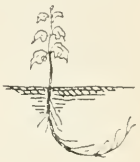


FIG. 10

There are other systems of planting, but they are not usually employed in Sylviculture, so no mention of them need be made here. Slips, layers, and suckers would not come under the head of forest planting in Victoria, though the latter often come naturally from eucalyptus trees, and in cases where forests are much infested with insects their encouragement is useful, but their artificial production would be expensive.

Tending of the Forest.

Having now planted the forest area, the difficulties, to a certain extent, have been overcome. But a point has not yet been touched on that is of vital importance to the future forest, *i.e.*, the distance the plants ought to be from each other. To begin with the young trees should be planted in lines, and these lines should be close enough to insure a complete shade to the ground surface when the trees are from four to five years old. As a rule the trees are planted the same distance apart in the lines as the lines are apart from each other, viz., 4 feet x 4 feet or 6 feet x 6 feet. The object being to obtain timber, we naturally do not want branches and leaves. To encourage stem growth only we must plant close, so as to exclude as much as possible the strong light except on the growing tops of the trees. Trees grown thickly are straighter and freer of branches, and have a longer bole than trees growning thinly. They need no pruning as, owing to the want of light, the branches die off. It is a great mistake to prune young forest trees, the best plan is to leave it to nature. If pruning has to be done, the cutting off of the branch must be clean and close to the stem, so as to allow of recovery as

quickly as possible. Pruning should also be done in the late autumn, when there is least chance of a flow of sap.

Thinning.

A properly planted forest ought to require little attention till it is five years old, and even then may not have made sufficient growth to require any assistance. But as age increases so will the struggle for existence become more severe. It will be found that some trees have grown faster than their neighbors, whilst others have been so far left behind that they have been killed. If left to nature the result would be fewer trees to the acre of good marketable quality, as those trees that topped and overshadowed their neighbors would not only spoil the growth of the trees they outstripped, but would, to a certain extent, tend to lessen their own, by growing large branchy crowns at the expense of their stems; or they would continue to grow together, and be so drawn up that their stems would be too weak to support their crowns, and they would bend over and prove useless for marketable purposes. Hence, man's assistance at the right time checks this evil, and encourages a greater volume of valuable timber. Let us consider now a thinning is necessary, the forest being 10 years old, the plants having been planted 4 feet x 4 feet, and the species being eucalyptus. If the growth has been rapid we shall find the following:—

1. Dead trees, killed for want of light or other causes.

2. Suppressed trees, hopelessly left behind, and which will eventually be killed, their crowns being completely covered by those of their neighbors.

3. Dominated trees that still fight for a share of light, and may have a leading shoot fully exposed, but, owing to their stronger brethren, are practically suppressed.

4. Dominating trees, the strong growers that are in full enjoyment of light and vigorous growth.

The first thing to do is to remove the dead trees, after that the suppressed ones must go, it is useless to leave them as they are bound to die, and we then come to the dominated. In a Victorian eucalyptus forest most of these could be cut out, as owing to the rapidity of growth of the species any small gaps made in the leaf canopy would be quickly filled up. Still it is never advisable to remove all as their presence tends to be beneficial to their neighbors in many ways, the chief being their protection to the ground. It is essential to a young forest to have the ground shaded from the direct sun's rays, so as to keep it cool and prevent the loss of humus. Therefore, the removal of the overhead cover will admit too much light and assist weeds to grow, and also, probably, result in the standing trees throwing out branches on their previously clean boles. Again, if strong light reaches the ground it will induce a regrowth from the stools of the cut out trees, and so frustrate the object of the thinning. Another thing to be remembered is that on flat land, with good soil, a severe

thinning does not, as a rule, do very much harm, but on steep or poor soils a severe cutting out may ruin a forest. There are many points to be considered when a forest requires thinning, and it is this that makes it one of the most important forest works, and on no account should it be intrusted to any but trained men. As a rule this operation is carried out far too severely, especially in young forests where it ought to be light. The general rule is to thin lightly in young growth, and increase the severity as the trees get older. With regard to diseased trees, they should come out at any cost; but as to the removal of crooked ones care has to be exercised, a crooked tree may be useless in itself, but its presence may be of the greatest importance to its neighbors.

The material produced by thinning can as a rule be sold, but should no market exist it ought to be burnt, so as to prevent fungi and insect pests getting into the forest. The stumps of the cut trees should, if possible, be covered with earth for the same reason. No other work is necessary till the forest is ripe for the axe, and when that time arrives a system has to be carried out to meet not only the market requirements, but also to insure, if possible, a natural reproduction by seed, described in the first portion of this article.

THE YEAR'S WHEAT YIELD.

By W. McLean.

Owing to the lateness of the season in some districts the collectors were compelled to obtain the best reliable estimate of the yield where threshing had not been completed. Returns from about 4 per cent. of the farms are still due, but in these cases the area and produce have been estimated.

RETURN (preliminary) showing the Wheat Yield for the Season 1903-4.

Counties, Geographically Arranged.	Area in Acres.	Produce in Bushels.	Average per acre in Bushels.
Lowan	148,700	2,002,224	13·46
Borung...	430,840	5,867,614	13·62
Kara Kara	109,410	1,747,403	15·97
Weeah	17,110	212,777	12·44
Karkarooc	266,670	2,841,646	10·66
Tatchera	246,100	2,938,867	11·94
Gunbower	36,690	533,390	14·53
Gladstone	93,000	1,551,806	16·69
Bendigo	88,740	1,715,726	19·33
Rodney	108,300	1,849,703	17·08
Moira	283,050	5,228,332	18·47
Remaining Counties ...	114,400	1,866,594	16·32
Cut for Grain	1,943,010		
,, Wheaten Hay ...	195,640		
Total	2,138,650	28,356,082	14·59

NOTE.—The estimate of the total yield in the State made last October was 26,522,000 bushels.

Old Stocks of Wheat and Flour.—On 31st December, 1903, there was equivalent to 14,200 bushels of Victorian old and 72,500 of imported wheat on hand (exclusive of 399,600 bushels in bond), but agaist this 312,592 bushels of the new season's wheat had been consumed up to that date.

MILK STRAINING.

By R. Crowe.

Although every care may be taken to keep milking yards and cowsheds clean, the cows groomed, the hands of the milkers and the udders and teats of the cows washed, it will still be impossible to prevent particles of dust, dandruff, hairs, etc., from falling into the milk.

With ordinary milk strainers only the large particles are prevented from passing from the milking bucket into the cans. In addition to the usual wire gauze, therefore, some dairymen use two or four folds of butter-cloth and thus secure much better results. Quite recently, cotton wool specially prepared for the purpose has been introduced, and as it more nearly approaches a filter than anything used in ordinary practice on the dairy farm, it restrains practically all the undissolved impurities. Each disc is burned after use, and a new one inserted for every milking, thus obviating all risk of contamination through strainers not being clean and sweet. Unfortunately, there are still some persons who consider straining unnecessary because the milk is only for the factory or creamery, or going to be separated. They fail to realise that as some of the impurities may have been dissolved by the time it reaches the separator, it is then too late to attempt to arrest the taints imparted to the milk, and all that can be done is to detain the coarser particles which may still be undissolved.

On receipt of particulars of this specially prepared cotton wool filter, together with improved types of strainers, I asked Mr. Carroll to test them at the Leongatha Labor Colony, and also requested Mr. Archer to try them on one of his visits of instruction to a Gippsland Cheese Factory. Mr. Carroll's report which follows indicates that the milk strained by the improved method immediately after milking, as well as the skimmed milk and cream therefrom, will keep better than that treated in the ordinary way. Mr. Archer's experience confirms Mr. Carroll's, and the accompanying photographs show clearly the great advantage of careful straining immediately after milking.

Mr. Carroll's Report.

The following is the result of experiments made with improved strainer at the Leongatha Labour Colony:—The milk from 76 cows was experimented on, half of which was passed through the above strainer and the remainder through an ordinary strainer. Samples were taken from the the whole milk, cream and skim milk of the above lots and

tested for acidity by titration method at time of separating and at intervals of 15 hours, 20 hours and 72 hours :—

MILK.

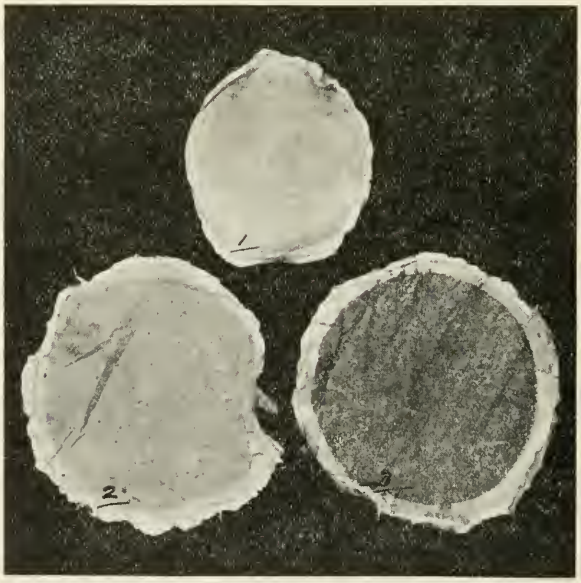
Strained by Improved Strainer.		Strained by Ordinary Wire Gauze Strainer.	
After milking	·18 acid	After milking	·18 acid
15 hours later	·23 ,,	,, 15 hours... ...	·28 ,,
20 ,, ,, ...	·36 ,,	,, 20 ,, ...	·40 ,,
72 ,, ,, ...	·99 ,,	,, 72 ,, ...	1·04 ,,

Samples of cream and skim milk were also kept from same lot and tested at the end of three days.

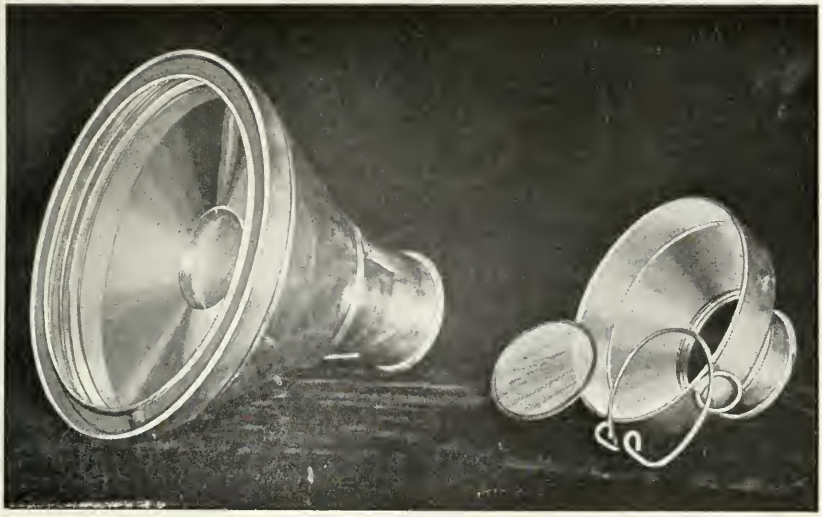
Milk Strained with Improved Milk Strainer.		Milk Strained with Ordinary Strainer.	
CREAM.			
72 hours after separation ...	·76	72 hours after separation ...	·81
SKIM MILK.			
72 hours after separation ...	·88	72 hours after separation ...	1·01

MR. ARCHER'S REPORT.

The accompanying illustrations show the effect of the improved strainer on milk. Fig. 1 is a disc of cotton wool before use, and Figs. 2 and 3 are discs through which 40 and 20 gallons of milk re-



spectively have passed, and it will be seen that the last is very much the dirtiest. Both lots of milk had previously been run through five



PARTS OF LARGE SIZE IMPROVED MILK STRAINER.

IMPROVED MILK STRAINERS STAMPED OUT OF ONE PIECE AND WITHOUT JOINTS

strainers, two of which were muslin. These pictures will afford some idea of the amount of dirt that would have passed into the cheese but for the use of the filter. Of course, to produce the best results the strainer filter should be used at the farm, to remove the dirt as soon as possible so that the organisms contained in the dirt may not be allowed to remain long enough in the milk to damage it to the extent that would be the case when, for instance, the night's milk is conveyed to the factory next morning. If these filters are used at the farm, whey conveyed in separate vessels, and the cans properly cleaned, the milk supply will be immensely cleaner and the product consequently of better flavour.

JUDGING BUTTER FOR COUNTRY SHOWS.

By R. Crowe.

It is not generally known that the Department of Agriculture undertakes to score butter for Agricultural Societies, and return it with a full report on each exhibit. The conditions are that the exhibits should be sent to the Government Cool Stores, freight prepaid, some time beforehand. In the case of export butter it is advisable for Societies to receive exhibits eight weeks before the date of the show, and consign them to the Government Cool Stores where they will be kept at a low temperature, taken out to thaw three days before the show, examined and points allotted the day beforehand, and then consigned per rail in cool truck to reach the Society the evening before or early on the morning of the show.

Attached are reports concerning the exhibits submitted at the last Traralgon Agricultural Society's Show. No doubt, on these reports the prizes were awarded, in Class 134 to the box marked No. 2, and the 2nd prize to box marked No. 3. In the case of Class 135, the award would have been made to box marked No. 3, and the 2nd prize divided between boxes marked Nos. 2 and 4. These reports are mounted on cards and displayed with the exhibits at the show, and afterwards become the property of the exhibitors. In this way visitors can see the respective merits of each exhibit, and recognise the basis of the awards. The report in itself is of value to each exhibitor, especially so to those who were unsuccessful.

The more general adoption of this system would popularise district butter competitions at local shows, and do much towards raising the quality of butter generally.

Report on Box Marked No. 1 Class 134.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 deg. Fahr. Judged on 7th November, and returned per iced truck on 9th November.

Points Scored.—Flavour ...	45	out of a possible		50	points.
Texture ...	29	,,	,,	30	,,
Condition...	20	,,	,,	20	,,
Total ...	94	,,	,,	100	,,

Remarks.—Showing too much moisture.

Chemical Analysis.—

Moisture	14·80 %
Fat	81·83 %
Curd	0·28 %
Soluble salts	3·05 %
Ash	0·04 %
	100·00 %

BACTERIOLOGICAL EXAMINATION.

In this sample about 100 colonies of *Oidium lactis* appeared, together with liquefying bacteria and yellow micrococcus.

REPORT ON BOX MARKED No. 2. CLASS 134.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 deg. Fahr. Judged on 7th November and returned per iced truck on 9th November.

POINTS SCORED.—Flavour ...	47	out of a possible of		50	points.
Texture ...	30	,,	,,	30	,,
Condition...	20	,,	,,	20	,,
Total ..	97	,,	,,	100	,,

CHEMICAL ANALYSIS:—

Moisture	12·52 %
Fat	83·82 %
Curd	·40 %
Soluble Salts	3·22 %
Ash	·04 %
Boric Acid	·45 %
	100·45 %

BACTERIOLOGICAL EXAMINATION.

In this butter the large number of liquefying bacteria present caused rapid decomposition of the culture media; most likely the water used in the washing of the butter was crowded with these objectionable organisms.

REPORT ON BOX MARKED No. 3. CLASS 134.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 deg. Fahr. Judged on 7th November and returned per iced truck on 9th November.

POINTS SCORED.—Flavour ...	46	out of a possible of		50	points.
Texture ...	30	,,	,,	30	,,
Condition...	20	,,	,,	20	,,
Total ...	96			100	

CHEMICAL ANALYSIS.—

Moisture	10·45 %
Fat	85·93 %
Curd	·48 %
Soluble Salts	3·09 %
Ash	·05 %
Boric Acid	·27 %
	100·27 %

BACTERIOLOGICAL EXAMINATION.

This butter, when examined for bacterial contents, was found to contain a few liquefying colonies and represents a fair bacterial condition.

Report on Box Marked No. 1. Class 135.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 deg. Fahr. Judged on 7th November and returned per iced truck on 9th November.

Points Scored.—Flavour	... 41	out of a possible of		50	points.
Texture	... 30	,,	,,	30	,,
Condition	... 20	,,	,,	20	,,
Total	... 91	,,	,,	100	,,

Chemical Analysis.—

Moisture	12·24 %
Fat	83·95 %
Curd	·21 %
Soluble Salts	3·53 %
Ash	·03 %
	99·96 %

BACTERIOLOGICAL EXAMINATION.

Cultivations made from this butter showed the presence of the mould, *Oidium lactis,* in large numbers, 15,000 per gramme, also a *Mucor* and liquefying bacteria.

The bacteriological condition was inferior.

Report on Box Marked No. 2. Class 135.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 degrees Fahr. Judged on 7th November, and returned per iced truck on 9th November.

Points Scored.—Flavour	... 42	out of a possible of		50	points.
Texture	... 30	,,	,,	30	,,
Condition	... 20	,,	,,	20	,,
Total	... 92	,,	,,	100	,,

Chemical Analysis.—

Moisture	11·77 %
Fat	84·46 %
Curd	·22 %
Soluble salts	3·51 %
Ash	·05 %
	100·01 %

BACTERIOLOGICAL EXAMINATION.

Contained a large number of micrococci, which form small yellow colonies and slowly liquefy, gelatine subcultures in milk cause coagulation accompanied with a bitter taste. These organisms are not generally found in first class butters.

REPORT ON BOX MARKED NO. 3. CLASS 135.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 degrees Fahr. Judged on 7th November and returned per iced truck on 9th November.

POINTS SCORED.—Flavour	... 42·5	out of a possible of		50	points.
Texture	... 30	,,	,,	30	,,
Condition	... 20	,,	,,	20	,,
Total	... 92·5			100	,,

CHEMICAL ANALYSIS.—

Moisture	11·79 %
Fat	81·69 %
Curd	·50 %
Soluble Salts	4·97 %
Ash	·05 %
	99·00 %

BACTERIOLOGICAL EXAMINATION.

This sample showed the presence of liquefying bacteria which very soon rendered the plate cultivations liquid. Possibly the water used for washing the butter was originally obtained from a river and not filtered.

REPORT ON BOX MARKED NO. 4. CLASS 135.

Received 21st October, samples taken for analysis, and then placed in chambers at 30 degrees Fahr. Judged on 7th November, and returned per iced truck on 9th November.

POINTS SCORED.—Flavour	... 44	out of a possible of		50	points.
Texture	... 29	,,	,,	30	,,
Condition	... 20	,,	,,	20	,,
Total	... 93	,,	,,	100	

Remark.—Showing too much moisture.

CHEMICAL ANALYSIS.—

Moisture	15·30 %
Fat	81·40 %
Curd	·58 %
Soluble salts	2·67 %
Ash	·05 %
	100·00 %

BACTERIOLOGICAL EXAMINATION.

The green mould *Penicillium glaucum* was present in the sample, along with liquefying bacteria and micrococci, deleterious to the keeping qualities of butter.

Ordinary colonies of *Bacillus lactici* were abundant.

TESTING MILK FOR TAINTS.

By R. T. Archer.

Cheesemakers often have to treat milk from which they cannot obtain a sweet, clean-flavoured curd, though there is apparently nothing suspicious in the milk when received, and it would be almost impossible to discover the cause of the taint, were it not that we are able to apply a test specially suitable for this purpose.

A fermentation test was long in use in the cheesemaking countries in Europe prior to the introduction of the Wisconsin curd test worked out by the dairy experts at the Wisconsin Dairy School, who have done so much for the dairying industry. The accompanying illustrations show clearly the construction of the apparatus which consists of a tin box (Fig 1), with a tap in the bottom

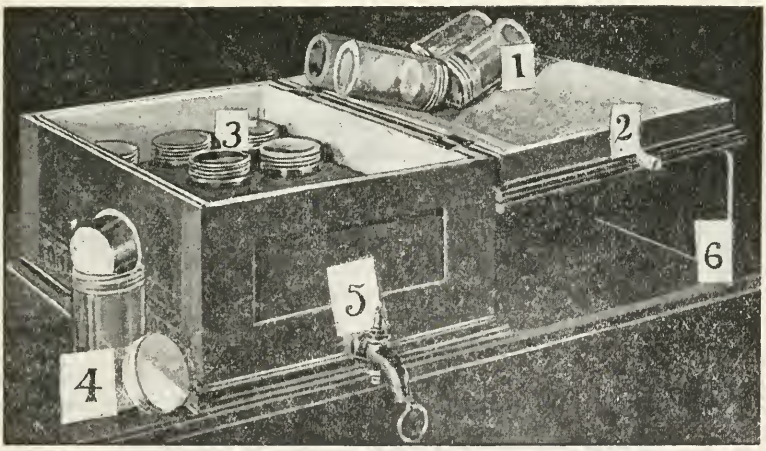


Fig. 1.—The Wisconsin Curd Test (after Farrington & Woll).
1, Test jars draining; 2, whey outlet; 3, test jars in water tank; 4, test jars in parts; 5, stop cock for water; 6, stand to support cover.

to run off the water as it cools, and to allow room for the addition of hot water. A wire frame fitting into the box, and resting on a ledge in each corner about half way down, holds the bottles in position and prevents them tipping over, thus allowing no water to leak into them to contaminate the tests. The lid of the box folds back, having a folding wire which drops down and acts as a support as

shown in the illustration (WS. Fig. 2). This lid is lined with tin dipping from the sides to the centre, on which the bottles are

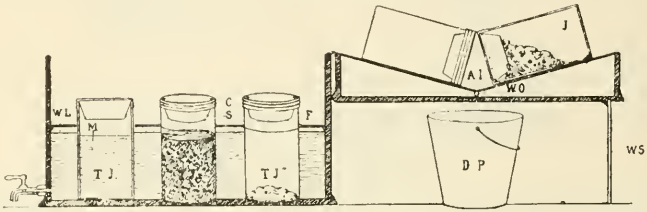


FIG. 2.—CROSS-SECTION OF THE WISCONSIN CURD TEST (after Farrington & Woll.)
TJ—TJ," testing jars showing different stages of test; WL, water line; M, milk; F, frame; WS, stand to support cover; AI, drain holes; WO, water outlet; DP, drain pail.

rested so that the whey may drain off the curd. The bottles used for the test are ordinary Mason jam jars, and for these a perforated lid and strainer adapted for the purpose of this test may be obtained from suppliers of dairy utensils. Before putting the milk into them, the jars must be sterilized and the best way to do this with a minimum risk of breakage is to put them all into a vessel of water containing washing soda in the proportion of about half a pound of soda to ten gallons of water which should then be brought to boiling temperature.

To make the test, fill as many pint glass jars as may be required three parts full, the milk being heated to 98 degrees Fahr. by standing the jars in warm water; add 10 drops of liquid rennet, mix with a rotary motion and allow it to stand in the water at 98 degrees for twenty minutes by which time the milk will have coagulated; then break up small with a knife and allow to settle, put in the strainer and drain off the whey as it separates from the curds. After the sample has been permitted to remain for from six to twelve hours, the temperature having been maintained at 98 degrees all the time, the curds may be examined; those having a bad smell or flavor, or a spongy, pin-holey, gasey or mushy texture, can be easily detected so that the milk producing the taint may be set apart. If it can be traced to a particular supplier, by similarly testing each cow's milk separately, it may be found that the milk from a particular cow is causing the trouble, perhaps from a diseased udder, and her milk may be kept apart until it becomes normal. Care must be taken not to contaminate one sample by mixing it with another through the medium of the thermometer and the knife, which should be cleansed and sterilized before inserting into each jar of milk.

The illustrations show the results of the application of the test. Fig. 3, made from the mixed milk taken from the cheese tank exhibits a curd of solid firm texture, the only holes visible being those of irregular shape due to the particles of curd not yet having settled together. Fig. 4 is the milk of one supplier and in it will be noticed several gas-holes, those of a round regular shape, like the holes in bread being due to the formation of gas consequent upon

FIG. 3

FIG. 6

FIG. 4

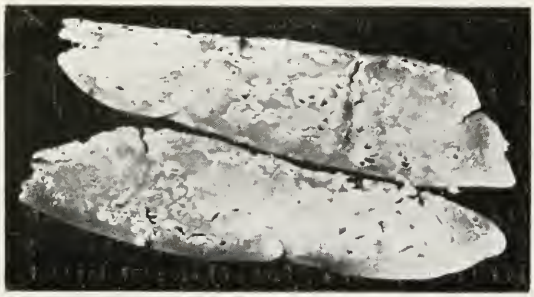


FIG 5

the action of a particular group of bacilli of the colon order which get into the milk through the medium of dirt. Fig. 5 is from the same milk as Fig. 3 but with the addition of a little whey from a dirty tank. The effect of this was astounding and the curd came out just like a sponge, which on being squeezed and freed again, relaxed and expanded. This test was conducted to prove to the suppliers the effect of carrying milk in improperly washed cans in which whey had been previously taken home. By providing separate vessels for the conveyance of the whey and then thoroughly washing and sterilizing the cans by steaming them at the factory this trouble was overcome. Fig. 6 illustrates a cheese made from milk highly contaminated by these gas producing organisms, the smooth, round, shiny holes being very distinct. The same effect will be produced by taking a sample of pure milk and adding a little cow dung, when the curd obtained will be full of pinholes. Until this taint is eliminated from the milk a good flavoured cheese cannot be made.

TESTING DAIRY COWS AT LEONGATHA LABOR COLONY.

By P. Carroll.

The following are the results of the first tests made of the herd of dairy cows at the Leongatha Labor Colony for this year. It is intended that similar records shall be made monthly in future.

The figures possess but a limited value as yet, and are more interesting as shewing the extent of variation in the quality of the milk from one milking to another and from day to day.

Coupled with the results of subsequent tests a valuable object lesson demonstrating the utility of testing dairy cows and keeping their records will be afforded.

The quantity of each cow's milk night and morning was weighed and a test made from four consecutive milkings, all the cows being treated under practically similar conditions.

Every care was taken to make these records reliable, for wherever a big discrepancy was noticed, the sample was retested or a fresh sample procured.

These results show how utterly unreliable a one day's test would be in ariving at the weekly product of a cow. In the case of No. 15 for example, the estimated yield of butter for each milking was 1·07 lbs., ·89 lbs., ·59 lbs., and ·61 lbs. The first two were for night and morning and show a total yield of 1·96 lbs. butter per day; the next two or the following day's, showed only 1·20 lbs, butter or ¾ lbs. butter less than on the previous day.

There are many other instances more or less marked, in fact the exception is where the tests are consistent, and the table requires no amplification.

Dairymen intending to cull their herd, after perusing the attached must necessarily come to the conclusion that in order to do so successfully, it will be necessary to extend the period of the test.

Number.	Name of Cow.	Evening of 23rd.			Morning of 24th.			Evening of 24th.			Morning of 25th.		
		Milk. Lbs.	Test.	Butter Lbs.	Milk. Lbs.	Test.	But-ter. Lbs.	Milk. Lbs.	Test.	But-ter. Lbs.	Milk Lbs.	Test.	Butter Lbs.
1	Sunbeam	10	5·2	·59	14	6·1	·97	10	5·7	·65	14	5·6	·89
2	Miskin	7	5·1	·40	10	5·4	·61	7	5·4	·43	8½	5·0	·47
3	Snowdrop	6	6·6	.45	10	4·0	·44	7	6·7	·45	10	5·2	·59
4	Daphne	9	4·2	·42	12	4·0	·53	8	5·0	·45	12	4·6	·62
5	Hazel	8	6·0	·55	14	5·0	·79	10	4·6	·51	13	4·8	·70
6	Fanny	14	5·2	·82	18	4·0	·80	14	4·0	·62	18	4·4	·88
7	Primrose	10	4·2	·47	16	4·2	·75	10	4·3	·48	17	3·8	·71
8	Ginger	11	4·2	·51	16	3·6	·63	10	4·0	·44	16	3·6	·63
9	Blackeye	9	5·2	·53	14	4·1	·63	10	4·9	·55	12	4·0	·53
10	Dairymaid	9½	5·9	·64	14	3·3	·50	10	5·0	·56	14	4·4	·69
11	Alice	10	4·6	·51	16	4·0	·71	10	3·9	·43	14	4·6	·72
12	Millie	9	4·8	·49	14	3·7	·57	10	4·6	·51	14	4·8	·75
13	Emma	12	5·4	·73	20	3·6	·79	12	4·7	·63	19	4·3	·91
14	Butterfly	14	4·4	·79	20	4·0	·89	14	4·0	·62	20	4·9	1·11

Number.	Name of Cow.	Evening of 23rd.			Morning of 24th.			Evening of 24th.			Morning of 25th.		
		Milk. Lbs.	Test.	Butter Lbs.	Milk. Lbs.	Test.	Butter. Lbs.	Milk Lbs.	Test.	Butter Lbs	Milk Lbs.	Test.	Butter Lbs.
15	Lassie	14	6·7	1·07	20	4·0	·89	14	3·8	·59	18	3·1	·61
16	Pansy	8	5·6	·51	13	5·2	·76	9	5·2	·53	13	4·5	·65
17	Myrtle	11	3·6	·43	15	2·6	·42	10	4·8	·54	18	5·0	1·01
18	Ladybird	4	4·6	·20	10	4·4	.49	6	4·5	·30	18	4·1	·36
19	Wait-a-bit	14	5·7	·91	18	2·4	·48	14	4·0	·62	18	4·3	·86
20	Grafter	10	4·7	·53	18	3·9	·77	13	3·9	·56	18	3·0	·58
21	Chance	10	5·3	·60	14	3·9	·60	10	5.2	·59	14	4·1	·63
22	Vida	7	5·0	·39	13	4·9	·72	8	5·4	·49	12	5·0	·67
23	Bella	8	5·2	·47	10	4·4	·49	7	5·8	·46	10	4·7	·53
24	Robeena	8	4·3	·38	14	4·2	·67	9	4·3	·43	14	4·6	·72
25	Cissie	10	4·5	·50	15	3·9	·65	10	4·8	·54	15	3·7	·61
26	Molly	6	3·6	·24	9	3·4	·33	6	4·8	·32	8	3·5	·31
27	Amy	8	4·5	·40	12	4·0	·53	7	4·2	·32	14	3·7	·57
28	Pet	10	5·6	·64	16	4·4	·78	10	4·9	·55	18	4·3	·86
29	Fuchsia	6	6·0	·41	10	4·3	·48	6	5·6	·38	9	4·5	·45
30	Connie	5½	6·7	·61	10	5·8	·66	6	6·1	·41	7½	4·3	·35
31	Gerty	8	5·3	·48	15	4·6	·76	10	5·4	·61	15	4·5	·75
32	Mignon	6	5·8	·40	9	4·8	·48	6	6·3	·42	9	5·4	·54
33	Biddy	9	4·7	·47	14	4·8	·76	9	4·7	·47	14½	3·7	·58
34	Myra	8	5·2	·47	14	4·8	·76	8	5·3	·48	13	4·7	·52
35	Norah	7	7·2	·55	12	6·8	·92	8	6·8	·62	12	4·3	·57
36	Nancy	9	5·3	·53	15	4·4	·73	10	4·6	·51	15	4·5	·75
37	Sarah	11	4·6	·56	14	4·8	·76	12	4·5	·60	15	4·5	·75
38	Star	9	5·2	·52	14	4·1	·63	8	5·0	·45	14	5·3	·84
39	Tiny	6	5·2	·35	10	3·9	·43	7	5·6	·44	10	4·4	·49
40	Bawley	10	4·6	·51	14	4·6	·71	10	4·0	·44	13	3·6	·50
41	Bell	8	6·5	·58	10	4·8	·54	7	6·1	·47	10	3·2	·35
42	Nugget	12	5·1	·69	16	4·0	·70	10	4·8	·54	16	3·4	·59
43	Stumpy	8	5·8	·53	12	4·5	·60	8	5·2	·47	12	4·6	·61
44	Bluey	9	5·3	·53	13	4·7	·67	10	5·6	·64	13	4·5	·65
45	Flossie	7	4·3	·33	10	4·4	·49	8	4·2	·37	11	4·4	·53
46	Jenny	8	6·0	·55	13	5·0	·73	8	5·2	·47	13	4·4	·63
47	Cowslip	9	4·3	·43	13	3·9	·55	9	4·4	·44	13	3·7	·52
48	Susie	9	5·1	·51	13	4·3	·62	9	5·5	·55	13	3·2	·65
49	Clover	10	6·2	·68	14	4·6	·71	10	4·8	·54	14	4·6	·71
50	Polly	8	5·3	·48	14	4·8	·75	9	5·7	·57	13	4·2	·60
51	Quiver	8½	6·0	·58	14	5·7	·91	10	5·3	·60	15	3·7	·60
52	Gipsy	11	4·2	·50	19	4·0	·84	12	3·9	·51	18	4·8	·97
53	Madge	10	5·1	·58	15	4·0	·66	10	5·0	·56	15	4·7	·80
54	Betty..	12	6·5	·73	16½	4·6	·85	11	5·2	·65	17	4·2	·80
55	Juno	9	5·0	·50	14	4·6	·72	10	4·9	·55	14	5·5	·87
56	Flirt	6	6·8	·46	10	5·7	·65	7	6·4	·49	10	4·2	·47
57	Ruby	7	5·4	·43	10	4·5	·50	8	5·7	·52	10	4·3	·48
58	Twinkle	7	4·4	·34	10	4·7	·53	7	4·4	·34	10	4·2	·47
59	Squeak	6	6·9	·47	10	5·4	·61	6	6·1	·42	9	5·5	·34
60	Bubble	8	5·2	·47	11	4·4	·49	8	5·1	·46	11	4·4	·54
61	Dinah	8	4·4	·40	12	4·1	·55	9	4·6	·46	12	4·0	·53
62	Flower	7	5·4	·43	10	4·2	·47	7	5·3	·42	10	4·6	·51
63	Fidget	11	5·5	·68	14	4·8	·76	10	5·3	·60	14	4·7	·70
64	Sweep	10	5·2	·60	14	4·3	·67	10	4·7	·53	15	5·2	·88
65	Peggy	9	5·6	·57	14	4·4	·69	10	5·4	·61	14	5·0	·79
66	Gunner	9	4·8	·48	13	4·6	·67	9	5·1	·55	13	4·7	·68
67	Mab	7½	5·0	·42	13	4·5	·65	9	5·2	·53	13	3·9	·56
68	Kate	9	5·1	·52	12	4·5	·60	8	5·5	·50	13	3·2	·45
69	Ivory..	7	5·2	·44	11	4·8	·60	8	5·1	·46	11	4·6	·57
70	Beauty	8	5·8	·53	10	5·0	·56	7	6·1	·49	10	4·6	·51
71	Scarlet	10	6·0	·69	13	5·7	·84	9	5·0	·50	13	5·2	·76
72	Dandy	8	5·7	·52	12	5·2	·71	9	6·1	·62	12	5·0	·68
73	Lucy	9	4·7	·47	15	4·5	·75	10	4·8	·54	16	4·4	·78
74	Maude	7½	5·6	·47	14	4·9	·77	10	5·1	·58	14	3·8	·59
75	Roaney	8½	3·9	·36	15	3·2	·52	10	3·8	·42	16	3·4	·60
76	Smoker	11	6·2	—	18	4·0	·79	10	4·6	·51	16½	3·2	·57

A MEANS OF PREVENTING CLOUDINESS IN WHITE WINES.

By M. d'A. Burney.

In many districts of Victoria the perfect clarification of dry white wines offers a serious difficulty. Much can be done towards preventing this by a commonsense treatment of the vintage. Apart from specific microbian diseases, cloudiness is often produced by an excess of albuminous matter formed naturally in the must. It stands to reason that the sooner this excess is eliminated the sooner will the wine clear and the less danger will there be of its becoming cloudy again afterwards.

The grapes when crushed should be pressed rapidly, and the must pumped into fermenting vats, and racked off the sediment formed before fermentation sets in. The must while being pumped, should be given as great a fall as possible into the vats, so as to insure complete aeration. At the same time tannin, in the proportion of at least 2 oz. per 500 gallons of must, should be added in order to assist the precipitation of the undesirable albuminous matters. An overdose of tannin is of no consequence, as it is easily got rid of by fining later on. In vineyards which contain both red and white grapes, the red grapes can be picked in the cool of the morning and the white grapes later on in the day. As the warm must cools down during the night, the precipitation of impurities is assisted, and, as a rule, the vat is clear enough to rack into casks the next morning. Care must be taken to eliminate any scum that may have formed on the surface, and to keep the thick lees quite separate from the bulk. They can be put in with the red grapes or else kept in a separate cask.

It is, of course, easy to elaborate this system by sulphuring the must so as to prevent fermentation, and only racking it after several days have elapsed, and when the must is quite bright. In this case it is necessary to get rid of the sulphurous acid by oxidation, and to add yeast to insure proper fermentation. In most cases the first process will be found sufficient, and two spare vats of a size in accordance with the pressing plant are all that is required. The moment the first violent fermentation ceases the wine should be racked and well aerated during the process. It can then be left in casks which are kept carefully filled until the winter sets in, when, if not perfectly bright, it should receive a light fining.

DRY RED WINES AND THEIR TREATMENT.

By M. d'A. Burney.

Part I.

Much diversity of opinion exists as to the exact time and under what conditions new wine should be first racked. A great deal, naturally, depends upon the climate and the composition of the must, as well as the conditions of fermentation and subsequent treatment. It might be advisable if we confine ourselves to the export type of wine only, because it is the type of wine of which there is a large production this season, and of which the treatment is of primary importance to producers.

It is too late now to discuss the most suitable varieties of grapes and their relative sugar strength and values, but the most approved sugar strengths are those varying between 13 degrees Beaumé and 16 degrees.

Theoretically, every wine intended to be dry should ferment out perfectly dry in the vat, but in practice this is often not the case, owing, as often as not, to the scantiness of fermenting space, as well as to the over-ripeness of the grape. It is obviously a very vital point with growers to obtain a dry wine under any circumstances rather than a semi-sweet unsaleable product, and no care should be considered too minute to obtain the desired result.

When the casks are filled from the fermenting vat, if the wine be not dry, every assistance should be given to the yeasts still contained in the wine to continue their action. What is sometimes called the secondary fermentation often continues for weeks, during which period the wine hardly clears at all, although the heaviest and dirtiest of the lees are deposited.

These lees are largely composed of yeasts, various ferments, mineral matters, pulp, particles of skin, seeds, &c. The yeasts, being living organisms, change more or less under the conditions in which they are placed. The cellules, which are well nourished during the fermentation in the vat, have accumulated a nourishing substance in reserve of a starchy nature called by Curtel * "glycogène."

When no sugar is left in the wine when taken off the skins the yeasts live upon this glycogène, and produce from it carbonic acid gas and alcohol, hence the increase in alcoholic strength often noticed in wines containing no unfermented sugar after lying on their first lees. Soon, however, the reserve nourishment is exhausted, and the yeasts living on their own albuminous matters, and producing excreta, assisted by numerous bacteria, frequently affect the bouquet and flavour of the wine.

It is quite obvious that the sooner the wine is freed from the organic matters contained in the first lees the better.

**Rev. de Viticulture*, vol. xvi., No. 417, p. 652.

The ancient method was to leave the wine upon the lees during the whole winter, and only rack part before the warmer weather set in. In many Victorian cellars new red wines are left upon their first lees for the alleged reason that they ferment out drier than if racked off them. In reality it is the system of racking that is at fault which destroys the very yeasts which it is most necessary to keep in activity. If a wine, intended to be dry, still contains a proportion of unfermented sugar it is necessary to use every means to prolong the life of the alcoholic yeast while separating the wine from all bacteria, who only look upon the unfermented sugar as their natural prey.

It is difficult to lay down a hard and fast rule as to when the period of first racking is reached, as wine making is not an exact science owing to the vagaries of climatic and other influences. Under some conditions musts containing 16 degrees Beaumé will ferment out perfectly dry, and the wine resulting will clear naturally and be fit to rack in the course of a month or six weeks. Sometimes the reverse is the case, or, what is more serious still, the fermentation ceases and the wine clears while still remaining sweet.

As soon as the wine is in cask, the wine maker must carefully test the alcoholic strength*, and continue to do so at intervals, carefully noting the results obtained, while at the same time paying particular attention to the state of the secondary fermentation. Before this shows signs of languishing, if unfermented sugar still remains in the wine, he must rack his wine, well ærating it during the process, into unsulphured casks, regardless of the degree of brightness or condition of the wine, while keeping his cellar at as warm a temperature as possible.

The oxidation will considerably assist the fermentation, and provided the maximum alcoholic strength be not reached, the wine will ferment out dry, when it should be again racked, but this time sulphured. What is the actual maximum natural alcoholic strength of a wine has yet to be determined, but as a general rule it lies between 27·5 and 28·5 per cent. proof spirit.

Another factor which most considerably affects the alcoholic production is the acidity of the must in the first place, but as the export market requires wines to be quite abnormally deficient in fixed acids, it is a point that can only be touched upon in this article. The treatment of the wine when it leaves the vat is also a consideration. Where continuous presses are in use, a first racking should take place within two weeks of devatting, or else the wines may be seriously deteriorated by contact with the heavy lees produced. When ordinary screw presses are used, the press wine can easily be kept separate from the rest, and then receive separate treatment.

If our export trade is to be increased and extended, it will be by improved methods of production and manufacture rather than the continuance of conservative and systematic carelessness.

*It can be done for him free of charge at any time upon his sending labelled and addressed samples to the Viticultural Station, Rutherglen.

UTILIZATION OF VINE-CUTTINGS.

Translated from the Revue de Viticulture, No. 526, by M. d'A. Burney.

Vine-cuttings are, so to speak, a waste product, they are considered of little value and are as a rule destroyed. An acre of vines does not produce a very considerable quantity; we have often weighed them and rarely found them average more than 1 lb. per vine. There is not, therefore, a very great weight of cuttings to be gathered, but the operation is costly and takes time. Whether or not the cuttings are worth gathering after pruning is what we are about to consider.

In certain countries where firewood is scarce, the cuttings are of value as fuel. Ordinarily they are burned, and the ashes—only 2 per cent. of the bulk—rich in potash and in phosphates, are spread among the vines.

The cuttings can be used for road making in sandy country, and also as somewhat primitive drains in moist districts. For the latter, ditches from 1 foot to 3 feet deep are dug, on the bottom of which is placed a layer of cuttings.

Besides this simple but very imperfect method of utilization, there are two other methods of greater and more rational interest. We mean that of vine-cuttings as a litter and a food for domestic animals. The problem of the best means of using them for this purpose is now solved. For some years, that is to say from the date of our first treating this question in the *Revue de Viticulture*, many growers have learned to use all their cuttings as a bedding or a food for their animals. Seven or eight years have proved the value of this method. Nothing is more simple than to make the cuttings take the place of hay or straw. Directly after pruning, and as fast as the operation is carried out, the cuttings are brought in to be crushed. There are now several very perfect crushers worked by horse or steam power, which perform this operation most satisfactorily; as long as the cuttings are green the crushers work well, but there is rather more difficulty when they are dry. They should not be crushed and stored, but only crushed immediately before being given to the cattle.

Working bullocks and cows do not at first take readily to this form of nourishment, but they soon become used to it, and actually get to like it. To facilitate digestion, rye, flour, or bran may be added.

Crushed cuttings form an excellent litter, hence an excellent method of making use of them, and they are therefore a precious resource which it is wrong to neglect. It is evident that cuttings

will not take the place of oats, but they contain an important quantity of nourishing and assimilable matters.

On most vineyard properties there is either an engine or a horse-works, which could be used during the winter months for the crushing of cuttings. The waste of the cuttings is therefore a mistake.

NOTE.—M. Gustave Giret, of Béziers, was one of the first to introduce crushed cuttings for feeding cattle, and he has fed all his working bullocks on them for years, substituting crushed cuttings for a portion of the hay. Experience has proved, however, the necessity of including a more watery form of food with them, and M. Giret uses cut mangels and swedes. He says "since my animals have been fed in this way, I have been able to notice no loss of strength or condition. They appear even to have more energy than under the old regime." (P. Coste-Floret, Travaux du Vignoble, pp. 78 *et seq.*)

HALF-YEARLY REPORT OF THE STOCK BRANCH.

By J. R. Weir.

Reports received from the various Border and District Inspectors of Stock bear evidence to the fact that the past season has, from a grazier's or dairyman's point of view, been a phenomenal one. From all quarters comes the welcome assurance that grass and water are everywhere plentiful.

The customary scourge of bush fires throughout the summer, in one or other portion of the State, has not this season been felt. Where on the northern areas but a year since nothing but miles of waste met the eye on every side, there is this year abundance of grass and water. Dams are everywhere full, and the stock are generally in good condition.

Possibly the quality of the grass may not be as good this year as in others when so much rain has not been prevalent throughout the summer, therefore perhaps the stock have not thriven as well as their owners might have desired, but the hardships the major portion of them endured throughout the State the previous season must be remembered, and consequently had much to make up. In the southern areas a comparatively dry winter gave place to a late season; the rainfall being well sustained during the summer, feed has been plentiful. The grass throughout the summer south of the Dividing Range presented more the appearance of a mild September, and autumn is heralded in with an abundance of green feed on every side.

Diseases in Stock.

Anthrax.—Only four cases of anthrax have been reported in this State during the past season, each of which was separated from the others by a considerable number of miles. In the North-eastern district there were two outbreaks, one in sheep, the other in cattle; the losses in each case were severe, but in each instance they were localised to the centre in which the disease appeared. The stock on these premises were promptly vaccinated, and the deaths checked on the property on which the cattle were grazing. With the sheep the mortality did not cease, but the deaths after vaccination were not due to anthrax, as proven by post mortem specimens submitted to Dr. Bull for bacteriological examination, who failed to find the bacilli except in one case, and then in a very mild degree. The sheep in question were old broken-mouthed ewes, and the strain on them in suckling their lambs was answerable for their deaths. In the Western district the outbreak was very severe in one case, but was checked at once, as in the cases previously cited, and there was no further trouble after vaccination. The other case reported caused but little loss. In order to check the spread of the disease the usual measures, which have been found effective, were resorted to in

dealing with the carcases and lands upon which these stock had been grazing.

Actinomycosis.—Reports furnished by the various inspectors of stock, show that this disease has not been so prevalent as it is in dry years, and owners are becoming alive to the fact that in its incipient stages it yields to treatment very readily. A few long standing cases, however, came under the notice of the inspectors, and were at once dealt with.

Pleuro-pneumonia.—From five different localities reports have been received of the presence of this disease on fourteen holdings. While inoculation, when pure fresh virus was used, proved efficacious in preventing the spread of the disease, and proper attention was paid to the tails of the animals inoculated all went well, but where the virus used had not been good, or the operation performed in a rough manner, the tails of the animals so treated assumed enormous proportions through blood poisoning supervening, and in consequence of this in some instances owners shot their cattle, as, in their opinion, treatment was useless and would only prolong pain to the unfortunate animal. Inoculation has been proved throughout Australia to be an invaluable prophylactic against this disease when due attention is paid to (*a*) the quality of the virus used, (*b*) handling the animal to be operated on quietly, (*c*) taking care not to injure the bones of the tail with the instrument (which should be thoroughly clean and frequently disinfected) with which the puncture or incision is made, and (*d*) attention to the tails afterwards. Due attention being paid to the foregoing details, no trouble will ensue, disregard or neglect of these will bring a train of worry and loss to the owners.

Tuberculosis.—There seems to be a marked decrease in the number of cases of this disease which have come under the notice of inspectors. It may be that the number of animals affected is less than in former years, or that owners of such animals, yielding to the advice given them by inspectors, destroy them, instead of, as in former years, either keeping them hanging on in their paddocks, a source of infection to other animals, or offering them for sale in the market yards.

Mortality in Calves.—In several districts there have been reports furnished stating that the mortality in calves has been up to the usual percentage to which they are subject, more especially weaners. What is locally known as black scour is answerable for very many of the deaths, while, in some cases, pleurisy claims its victims. Owners have themselves to thank very often for their neglect of young stock, cruel alike to the survivors and those that succumb. White scour, fortunately, has not been prevalent.

Worms.—One or two cases only of this trouble have been reported during the past season as having occurred throughout the State, and it seems highly probable that in localities where losses have occurred previously, owners have taken precautionary measures to prevent further trouble.

Other Diseases.—No losses are recorded from fluke or liver-rot, but accounts of various other diseases of a non-contagious nature have been received and investigated. From one district a case involving the loss of some sixty sheep from vegetable poisoning has been dealt with. On the matter being reported, Inspector Lawler conducted post-mortems on some of the carcases, and was of opinion that poison obtained from some herb in the pasture was the cause of the mortality. Bacteriological examination of specimens submitted to Dr. Bull substantiated this opinion, no bacilli likely to cause fatal results being found by him. Death still continuing in the flock, Mr. Runting, V.S., was instructed to deal with the case, his finding, as the result of three post mortems, was that death was due to vegetable poisoning, and several plants were forwarded to Mr. Luehmann, F.L.S., Government Botanist, and none of them, in his opinion, were noted poisons. The sheep were removed to another pasture and the deaths ceased. It is but right to add that as the greater part of the land was ploughed down before any botanical specimens were collected it is more than probable the plant which caused the trouble was ploughed in, and consequently lost. Water from which the animals drank was analysed by Dr. Howell, but no trace of arsenic, phosphorus, strychnine, or cyanide could be detected.

Horse Ailments.

This animal seems to have had considerable immunity from disease during the past season. In but one instance has a report come to hand of any serious trouble, and then only from the Northern district, where the animals had suffered so much during the previous season from want of feed, and the scanty supply received being of an innutritious nature. The case was investigated by Inspector Cother, as soon as information was received, and he ascribed the trouble to rickets. The affected animals were chiefly yearlings and two-year-olds, whose dams either had died after foaling, or if they lived were weak from the disastrous period alluded to. As soon as the grass matured the trouble ceased.

Swine.

Since my last report the swine fever epidemic has been gradually dying out, and there is every hope that if owners take this matter in hand with a determination to stamp the disease out they will eventually do so. Legislation is powerless unless those interested lend their assistance; if, on the other hand, they persist in shirking their responsibilities the disease will be ever present. At the present time there is an undoubted subsidence of it. The pig is an important unit in the wealth-producing power of the State, and is deserving of more consideration, both in regard to quarters and food than is generally accorded to him. In the opinion, evidently, of many owners no quarters are too foul or dirty, and no food too putrid or disgusting to offer the animal. In the face of this treatment it is not to be wondered at that the constitution of the animal, through successive

generations of ill-treatment, becomes at last a prey to typhoid and pneumonic affections. Preventive measures should be adopted to at least check this condition of affairs, such as clean, warm beds, shelter from wind and rain, together with proper food, and the results obtained will repay the change.

Inspectors' Work.

The season just closed has been a particularly heavy one for the staff of this branch, in connection with the inspection of imported stock, markets, piggeries and reported outbreaks of disease throughout the State. Within the State, since July last, 147,758 cattle have been inspected; of this number 87 were killed and 78 isolated, making a total of 165. Those animals which were killed, were destroyed on account of pleuro-pneumonia, tuberculosis, and actinomycosis in an aggravated form.

Imports of Foreign Stock.

Horses.

For the period under review 25 horses have been imported from England and India. From the former country five very fine draughts have been introduced by Mr. S. W. Gibson. Photographs and description of these animals will be found in this number of the *Journal.*

Cattle.

Eleven head of cattle have, since my last report, arrived here from England, of the Shorthorn and Jersey breeds, Sir Rupert Clarke and the Messrs. Chirnside being the principal importers.

Sheep.

Some very valuable Shropshires, consigned to Messrs. J. M. Peck and Sons, arrived here within the past few months. In all 119 have been imported from some of the leading flocks in England, and should tend to produce an animal well adapted for export as a freezer. The quality of these animals may be judged when it is stated that many of them have since been exported into other States.

Dogs.

Twenty-six dogs of various breeds have been imported from England, China and Japan during the currency of the period dealt with herein. Yorkshire terriers seem to have the greatest number of fanciers. Japanese spaniels and Chinese pugs also have been favored.

Pigs.

Three were introduced from England during the past season, these being of the Tamworth variety, and arrived to the order of Mr. Chirnside, Werribee Park.

TREATMENT OF BOTS IN HORSES.

By A. A. Brown, M.B., B.S.

Bots, which are larval stages in the development of the bot fly (*Gasterophilus equi*), inhabit the stomach of the horse. The stomach of the horse is divided into two parts. The left half is covered with a lining which is a prolongation of the lining of the gullet, and is pale in color, and does not secrete gastric juice. The right half is lined with a reddish velvety membrane, and secretes the gastric juice. The bots reside in the left half of the organ, and they remain there during the greater part of autumn and the whole of winter.

Bots present several phases in their development.

(1.) In the first stage the eggs are found adhering to the hairs of the horse. The eggs are usually deposited by the fly on those parts of the body of the animal readily accessible to his tongue, and on licking his skin he removes the eggs and introduces them into his stomach.

(2.) The egg undergoes the next stage of its development in the stomach, and attains the grub or bot state. In this stage it maintains its existence in the stomach.

(3.) About the beginning of spring the bots spontaneously leave the horse's stomach to undergo the third or pupa stage in the ground.

(4.) The fourth stage is the winged insect stage (bot fly). The adult flies prevail during summer and early autumn.

As regards treatment, preventive measures are of paramount importance, and should, as far as practicable, be carried out in those districts in which bot flies extensively prevail. It is during the summer and early autumn that the bot fly is seen hovering about horses, always on the alert to dart down upon its victims and deposit its eggs. The female has an arrangement (ovipositor) which is a tubular prolongation of its body, by means of which it can readily attach the eggs to the hairs of the horse by a glutinous substance which is secreted at the time of the deposition of eggs. Bot flies make swift darts down upon horses and probably deliver a blow, but they do not sting. At those seasons when bot flies prevail those parts of the horse that he can reach with his tongue should, if practicable, be examined, and if eggs are observed adhering to the hairs they should be washed off with a 5 per cent. solution of caustic potash. The alkaline solution dissolves the glutinous substance that binds the eggs to the hairs.

During the summer and early autumn, as a preventive for bots, horses should be kept closely clipped and a 5 per cent. solution of valerianate of soda in any crude paraffin oil should be rubbed over those parts of the body accessible to the tongue. Besides valerianate of soda, other substances, such as the fluid extract of asafœtida,

eucalyptus oil, and formalin, which communicate pungent and persistent odours might be given a trial to ward off the flies. It has been observed that the flies dislike certain odours, and trials in the direction indicated are worthy of being made. One rubbing with paraffin oil will last fully a fortnight, providing weather be dry. In fact, clipping close the hair over those parts accessible to the tongue should always be done, as then the flies would have a difficulty in effecting a lodgement of the eggs. Moreover, when clipped, the parts can be more readily anointed with the paraffin oil. Crude paraffin oil can be got for about 4s. per gallon. Birds eat the grubs when they pass with the droppings, so birds are inimical to the development of the bot fly. Fowls allowed to scrape about dung heaps will devour the bots. All droppings containing bots should be mixed with unslaked lime, and the lime will kill the bots.

When the eggs have been introduced into the stomach of the horse they there develop to the bot stage, and efforts must be made to rid the animal of the invaders. Some time ago the late Dr. Moore, of Beulah, approached me concerning the way horses in the district were scourged by bots, and I recommended him to carry out a treatment which I had long advocated, and he subsequently reported to me that he was astonished at the result. Preliminary to the administration of the specific the animal is deprived of food for a few hours. No food is administered, say, after about 4 o'clock in the day treatment is commenced, but the animal may be allowed access to water. At night a pint of raw linseed oil is given, and on the following morning a drench is administered consisting of

Bisulphide of carbon ...	40-60 drops.
Oil of turpentine	2 teaspoonfuls.
Ether	1 teaspoonful.
Beer or milk	1 pint.

An hour or so after the administration of the drench a warm bran mash should be allowed.

The bots inhabiting the stomach will be poisoned with the fumes of the carbon bisulphide, and will be expelled dead. After three or four days have elapsed the treatment should be repeated to see if any of the parasites have remained behind.

Pure bisulphide of carbon is a colorless liquid almost insoluble in water, but is soluble in oils and ethers. It undergoes alteration in the light, so it must be kept in a dark place. It is, moreover, extremely volatile and inflammable, and must not be brought near a flame, as an explosion would ensue.

As a remedy for expelling bots gasoline also has a value. One ounce of gasoline in a pint of raw linseed oil or milk should be given to a draught horse. The dose should be repeated every day for three days. Nearly all vermifuges are more or less poisonous in one way or another, but, if properly used, they are not particularly dangerous.

If any untoward symptoms occur after giving the bisulphide of carbon drench, a pint of milk containing four teaspoonfuls of baking soda

should be given, and if any occur after the administration of gasolene, 2 teaspoonfuls of aromatic spirits of ammonia in a pint of milk should be administered.

The treatment of bots in the rectum (the larvae of the *Gasterophilus hæmorrhoidalis*) consists in the injection of a solution of common salt or of quassia water. Raking out the rectum can also be resorted to for removing the parasites.

A UNIQUE SHIPMENT.

Mr. James Kilpatrick, Craigie Mains, Kilmarnock, has made quite a unique shipment of high-class pedigree Clydesdales to Mr. S. W. Gibson, Fenwick Stud Farm, Yan Yean, Victoria. Mr. Gibson stipulated the three mares were to be in foal to three champion stallions, Hiawatha, Baron's Pride, and Baron of Buchlyvie.

(1) The stallion Mazawattee (10,817) is by Royal Favorite out of a Brooklyn mare, and during the past season had the Dundee and Carse of Gowrie premium. He is bay in colour, and a big-sized, massive horse of fine quality, with very flash legs.

(2) Royal Title (11,925), brown stallion, bred by Messrs. Crocker at Fyvie, is by Prince Thomas out of Eveline, by Garnet Cross. He has grand feet, clean bones, plenty of size, and is rising 4 years.

(3) Lady White, rising 4 years, is a bay mare bred by Mr. Frame, Greenfield; is by Hiawatha out of a Sir Everard mare. Had an unbeaten career as a 3-year-old, and is expected to prove in foal to Baron of Buchlyvie.

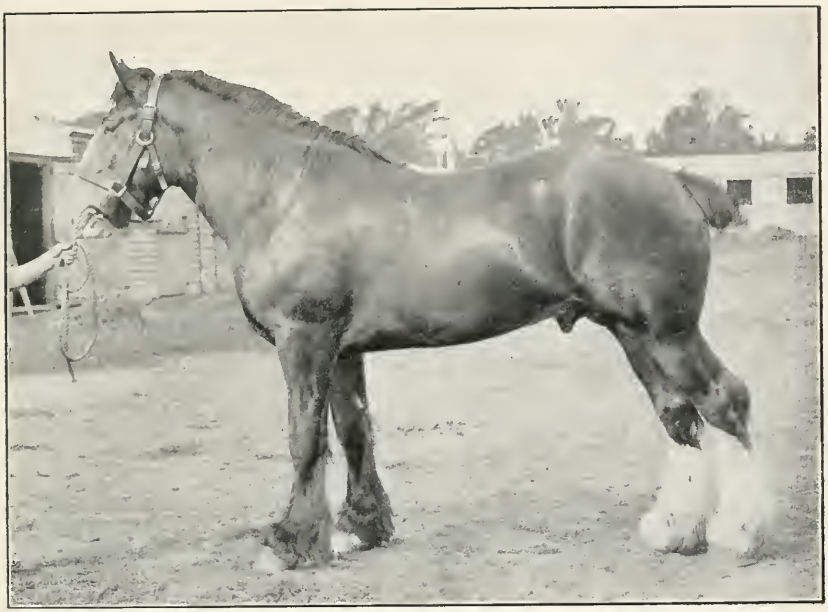
(4) Lady Horatio, brown mare, 7 years, by Goldmine out of Lady Grace Rowan, bred by Colonel Stirling, and has been stinted by Hiawatha. She is a stylish, quality-boned mare, with beautiful action, and fine feet and legs.

(5) Donna Roma, brown mare, by Macgregor out of Young Sarah Bernhardt, is of great size and quality, and has been served by Baron's Pride.

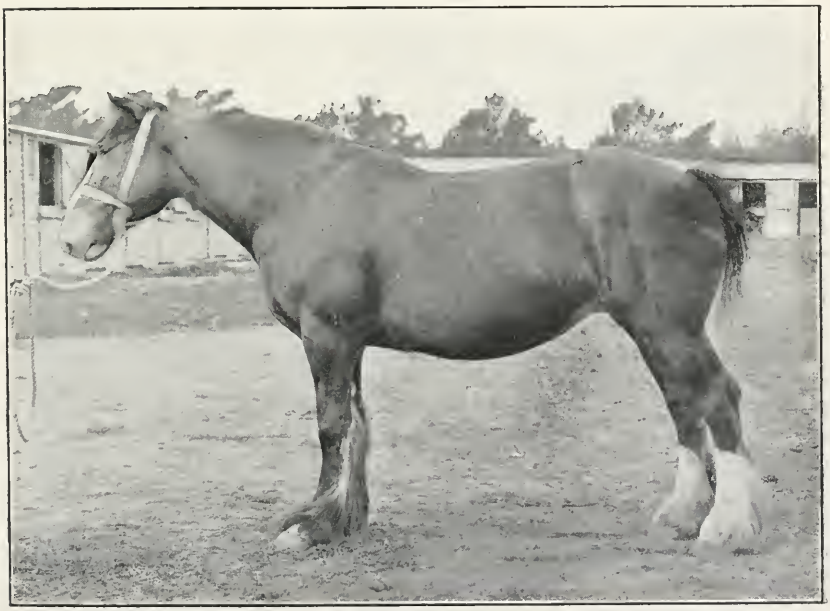
The Scottish Farmer.

R. S. Brain, Govt. Printer.

MAZAWATTE.



ROYAL TITLE.



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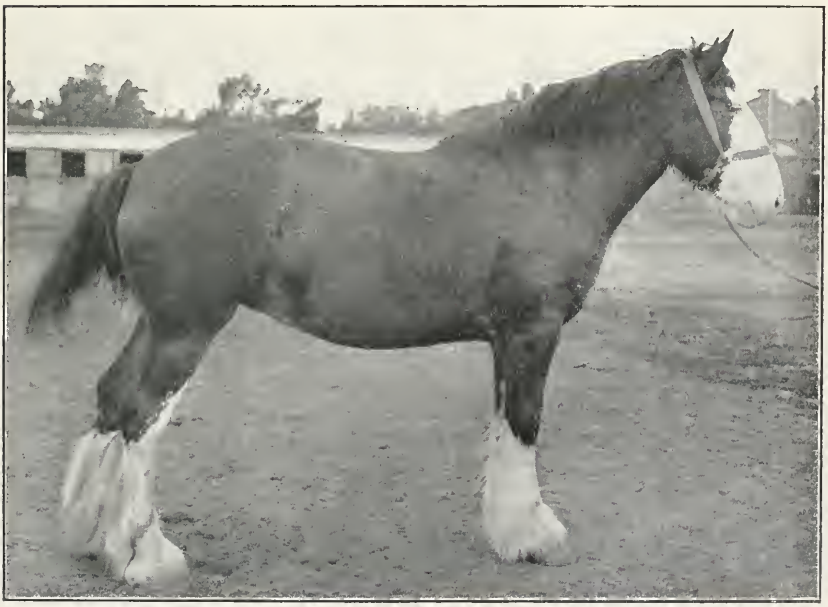
LADY HORATIO.

DONNA ROMA.



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LADY WHITE.

TOBACCO EXPERIMENTS AT EDI.

By Temple A. J. Smith.

Preparation and Treatment of Seed Beds.

The work of preparing seed beds at the Government Tobacco Farm was commenced in June, 1902, by burning a quantity of bush timber, bark, etc., on the sites chosen, both on the high land and the flats. This practice is to be recommended, as it not only enriches the soil, but all vegetable seeds are destroyed, and much labor is saved later on in weeding the beds when the plants are growing, whilst some of the earliest and best plants were taken from the burnt beds. After burning, the surface was carefully raked over to remove all lumps of ash, stones, etc., and the soil dug over to a depth of five inches, and left in a rough state to sweeten by frost and weather. A month later the beds were formed about 6 inches in height, and 3 feet in width, the soil being well worked and pulverised. Other beds were made level with the surrounding surface, also some with the tops arched and well raised, and some with flat tops. Seeding was commenced on July 27th and continued, at intervals of two weeks, up to September 16th. The early sown beds produced the strongest and best plants, being better rooted than those of later growth. The level flat beds were the most successful, but it must be remembered that the season was the driest known for many years and plants were grown in low-lying places which could not have been attempted in ordinary seasons, and careful growers should try different localities and aspects so as to be prepared for wet or dry years.

Various coverings were used for the purpose of protecting the young plants from frost, insects, wind, etc. The old practice of covering with straw or grass laid on the top of the bed until the plants were fairly strong was tried. Other beds were enclosed with a wooden frame made of boards 18 inches high, and cheesecloth supported by battens stretched across. Beds were also sown under glass cover, with a close frame surronnding them.

Of the three systems, that of covering with cheesecloth, and enclosing with boards or logs, is undoubtedly the best. The plants are well protected from frost, hail, cold winds, and sudden changes, they require less watering and insects cannot reach them so readily. Care should be taken to harden the plants before transplanting, by exposing them for a few hours daily without the cover, beginning in cloudy weather if possible. The glass covered plants are apt to grow too fast, with a long stem and small root, and do not stand transplanting well.

The plants grown under straw or grass are much subject to damage by insects, and severe changes of weather. When successful they transplant well, being hardy, but are later in reaching the transplanting stage. The cost of covering with cheese cloth is slight, and 40s. will provide sufficient to cover beds enough for 7 or 8 acres, the same cover will last two seasons, and the saving in labor by watering and weeding is considerable. Plants grown on the

upland, with a fair percentage of clay and a northerly aspect were best, while those on the flats did not thrive well owing to the sandy nature of the soil, and the drought, though constantly watered. The beds seeded on August 6th were the first available for the field. The use of superphosphate, sulphate of lime, and complete manure, was tried separately on beds before seeding, the superphosphate having a marked effect in assisting the growth of the plants.

The same experiments were carried through in the season 1903-4, which was a wet one, and the raised beds on the flats produced the soundest and best plants, those under cheese cloth cover being again the most successful. The clay soil of the upland held the moisture too long during the wet season, and plants were not so good from those beds as in the previous year, being also first to take the mould. In order to provide against the different seasons, it would be wise to have beds on both high and low land, some in well drained situations, others in places where the moisture will not escape too rapidly.

Blue Mould Experiments.

In the season 1902-3 no mould appeared, but in 1903-4 the mould was very bad, and destroyed all the plants on some of the farms.

PLAN OF SEED BEDS.

		BURNT.		UNBURNT.	
Level beds. .	1				
Raised beds ..	2				
Beds treated with bluestone ½ lb. to 10 gals. ..	3				
Beds treated with boiling water	4	BEDS NOT COVERED.	BEDS	WITH	BEDS NOT COVERED.
Beds untreated ..	5		CHEESE	CLOTH	
Seed sprouted prior to sowing	6		COVER	ING.	
Beds treated with superphosphate ..	7				
Beds treated with complete manure	8				
Beds treated with sulphate of lime	9				

Beds treated with	1 LB. BLUE-STONE,	1 LB. LIME,	IN 10 GALS WATER.
Beds treated with.. ..	LIME.	SULPHUR.	UN-TREATED

TOBACCO CROP AT EDI.

SEASON 1903.

HESTER TOBACCO

COW PEAS, FODDER PLANTS, CIGAR HOUSE, TOBACCO BARN AND RESIDENCE AT EDI.

INTERIOR OF CIGAR HOUSE

Of the experiments shown here, the beds treated with a mild solution of bluestone were the last to take the disease, and suffered least, especially those under cheese cloth covers. The covered beds treated with superphosphate were next best. The burnt beds and those treated with boiling water matured first, and had less weeds than the unburnt and uncovered.

The mixture of 1 lb bluestone, 1 lb. lime to 10 gallons of water proved too strong for the seed, and very little germinated, and it is also too strong for spraying the plants. Lime and sulphur treatment had no apparent effect, either in treating the beds before seeding or after the plants were well up. Kerosene emulsion was also tried after the disease appeared without effect. Plants grown under glass were delicate and transplanted badly.

Raised beds in wet seasons and level beds in dry are best.

Sprouted seed is useful if late in seeding, as two weeks can be gained by so treating. Good results can also be obtained by manuring, the superphosphate being the best fertilizer used.

Beds high up in the hill with a northern aspect did fairly well, and should always be worth trying when possible. All the experimental beds for prevention of mould were seeded with one variety, viz., Hester, on August 24th.

Variety Tests.

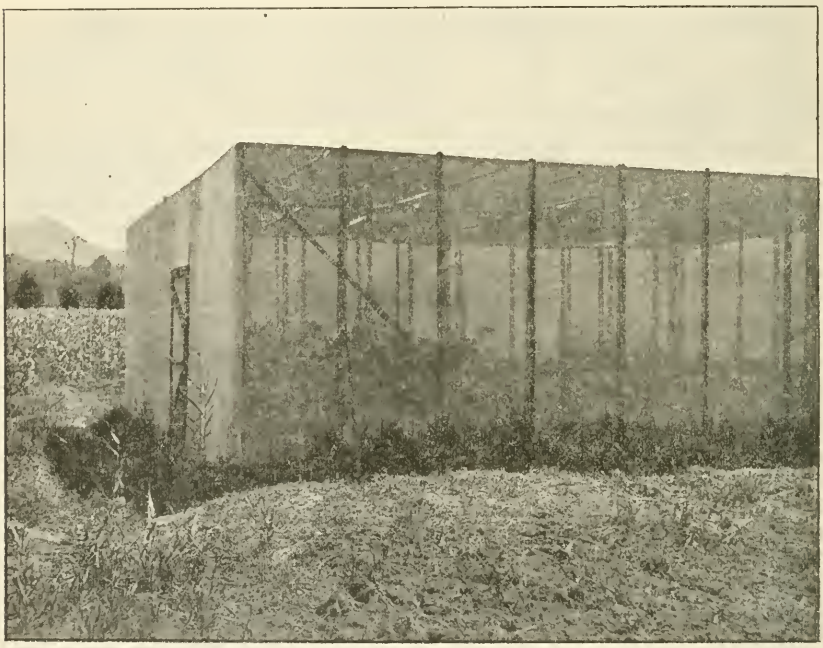
Sixteen varieties were tried in all, 12 of which were pipe or manufacturing tobaccoes, and four cigar. The names of the former were: Hester, Hyco, Conqueror, Lacks, Blue Pryor, Granville Yellow, Colonial Broad Leaf, Virginia India, Long Leaf Gooch, Dark Virginia, Carolina Yellow, and Kentucky Burley. The first seven of these did well, but the last five failed partly owing to the dry season, and the seed also, which was recently imported, was I think very old. The Conqueror, Lacks, and Blue Pryor were the first ready for putting out in the fields and the Hester and Colonial Broad Leaf a few days later. The Hester is, in my opinion, the best of the pipe varieties yet tried, having a nice heart-shaped leaf, not too large, with small mid rib. It matures early, and cures a brighter color than the others, while it is also an easy plant to handle, the leaves growing well apart on the stem. The Conqueror is also a nice tobacco, having a pointed leaf, growing a long distance between the leaves, curing a red color. The Lacks and Blue Pryor are fine heavy tobaccoes, and would give large yields, but the mid-rib is coarse, the same remarks applying to the Colonial Broad Leaf. The Granville Yellow and Hyco are not such robust growers as any of the former, but have nice quality and would grow bright tobacco on a lighter class of soil.

Of the cigar varieties, viz., Comstock Spanish, Connecticut Seed Leaf, Sumatra, and Cuban Havana, the three first thrived well, the Cuban Havana seed failing to germinate. The two first-named are strong growers, the Connecticut Seed Leaf being a heavy yielder, with leaves growing close together on the stalk. It is slow in

maturing, and cures brown, but grown in the field on heavy rich soil is too coarse. The Comstock Spanish is not such a heavy yielder, the leaves growing cleaner on the stalk. It matures fully two weeks earlier than the other varieties, and cures a light brown, with a nice aroma. The Sumatra is a delicate grower, curing a lighter color than the others, matures fairly early, but, from a short experience, does not appear to stand our climate well.

Cigar Leaf Grown Under Cover.

The experiment of growing cigar leaf under cover, "a practice largely followed in America," was attempted with most satisfactory results. The building was made of bush timber, 9 feet in height and



Cigar House at Edi.

30 feet square, the sides and roof being covered with cheese cloth. The cost per acre, in America, is estimated at £70, but I believe that where bush timber is available this estimate could be much reduced. The life of the cheese cloth is two years, while that of the frame would be five or six years. The varieties used were Comstock Spanish, Connecticut Seed Leaf, and Sumatra. The report on these tobaccoes by the States Tobacco Co. was to the effect "that they were the best samples of Australian cigar leaf ever submitted to them, and they would be prepared to purchase a large quantity at a price payable to the producer, allowing for the extra cost of growing under cover."

The texture of the leaf was much finer, the ribs much smaller, and the leaf sounder owing to the protection from insects and weather. The crop would be safer as there is less evaporation and a smaller rainfall would suffice. The plants start better as they are not subject to the direct rays of the sun when first transplanted. The work of keeping down grubs is not so great, and the damage from wind and frost is avoided. Therefore, when once the structure is erected, much of the ordinary labor of attending the crop is lessened, the leaf grows large, but of much more delicate texture than that in the open field, and I am of opinion that a still better quality leaf could be grown in this way upon a lighter description of soil.

Soils.

The soil on which all the experiments have been carried out, is a rich black alluvial flat with a large percentage of sand on the surface, especially in patches, with a heavy dark subsoil containing rather too much clay. There is a large area of similar soil in the North-Eastern district, but there are lighter descriptions of soil on the flats and uplands which I believe would produce a better quality of leaf. The variety of soils in the district extending from the Broken River to the Murray is very great, and by choosing the better varieties of tobacco to suit the different soils a very superior leaf can be produced to that hitherto grown. The tendency of most growers, in the past, has been to grow the heaviest yield, without sufficient regard to quality, the complaint of the buyers being that Victorian leaf is too coarse, and this can be obviated by attention to soil and variety. It has been proved that improved kinds will thrive equally as well as the old types. The change of seed would in itself be an advantage. During the season, 54 growers have been supplied with seed of better types from the farm.

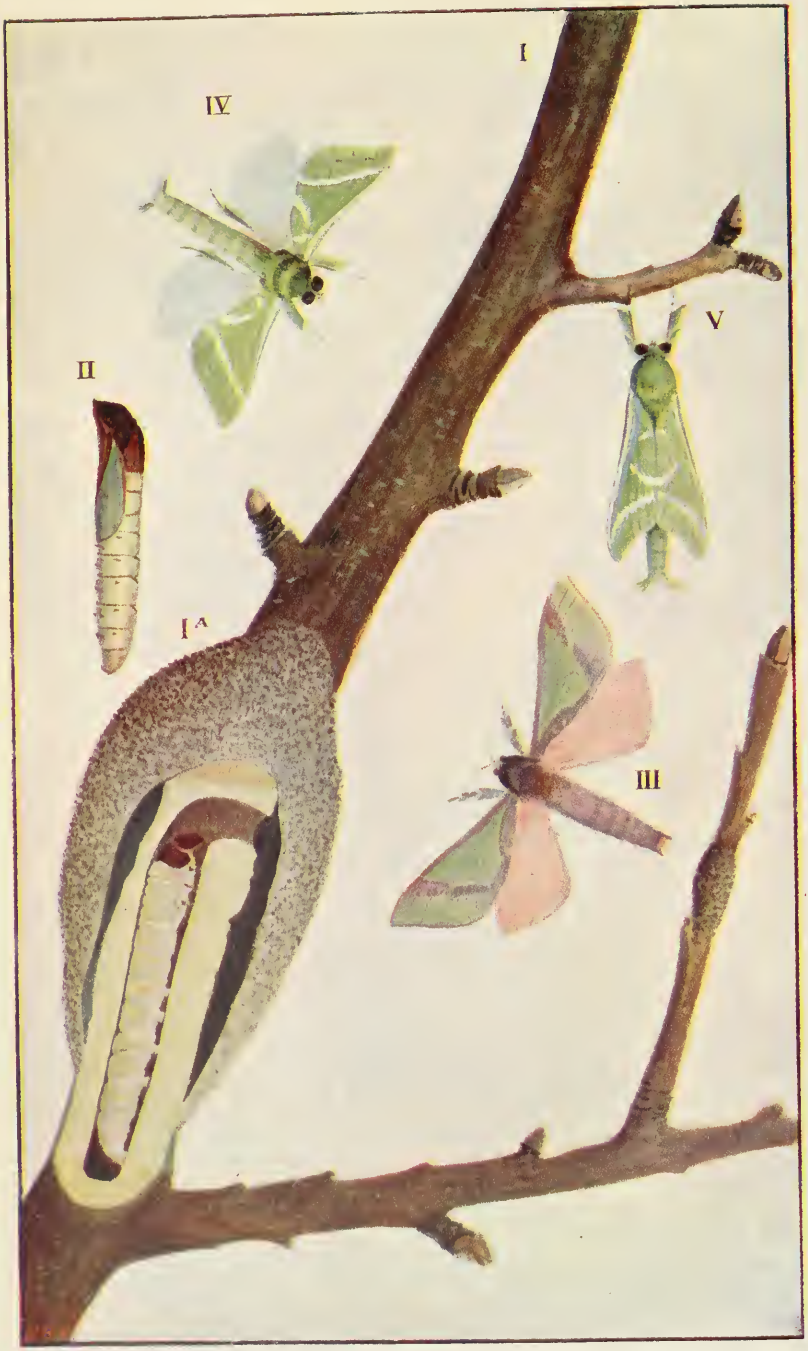
Summary.

Several important results have been obtained through the experiments carried out at the Government farm during the past year. In the first place it has been shown that the finer classes of tobacco can be successfully cultivated, and the adoption of these varieties must in itself greatly improve the quality of Victorian leaf, provided the soils are chosen to suit the variety, or *vice versa*.

Also, it has been proved that, by proper care and conditions, a good cigar leaf can be produced at almost the first trial, which the manufacturers are prepared to buy at payable prices. And though an absolute cure has not been discovered for the blue mould it has been checked to a great extent, and by using good judgment in choosing sites for seed beds, and the treatment of the soil by burning before seeding, and covering with cheese cloth, even in a bad year for the disease, sufficient plants can be obtained to plant out the plot.

Much further good could be done if growers in the various districts would undertake to grow the different varieties of tobacco, cigar and plug, in order to test their suitability to their particular soils, also fresh seed of chosen tobaccoes from America would be advisable.

Tests are now being made of leaf, from each of the 15 manured plots, by the manufacturers in order to ascertain the effect of the different fertilizers on flavor, fire holding capacity, ash and other points, results of which are not yet to hand. Much credit is due to the men employed on the farm, Messrs M'Crindle and Owens, for their close attention to the detail work, which was considerable, and the interest taken by them generally to make a success of the experiments.



C. C. Brittlebank, Del. C. French, Direx

APPLE TREE HANGING MOTH.

(Charagia Lignivora.)

A NEW APPLE PEST.

By C. French, F.L.S., F.E.S., F.R.H.S.

The Apple-Tree Hanging Moth.

(Charagia lignivora, Lewin.)

ORDER, Lepidoptera. FAMILY, Hepialidæ.

This new pest of the apple grower has been brought under my notice for the first time by Mr. Grant, the well-known orchardist of Pakenham, the specimens herein figured having been reared by myself from examples found in the orchard above-mentioned.

The fine family of the Hepialidæ is by no means an extensive one, although of universal distribution, and comprises some of the largest and most beautiful moths known to science. In Victoria, the genus *Charagia* is represented by three species only, the moth under notice being the smallest of the three. In New South Wales and Queensland, however, the genus is more largely represented, the two largest species, *C. ramsayi* and *C. mirabilis* being amongst the most beautiful insects in existence.

Unfortunately for our forests these insects are, whilst in the larval stage, terribly destructive to the native timber, and the death of some of the most valuable trees may be traced to the depredations of several species of the genus under notice. The species of this genus are mostly very variable, and as a rule, the sexes are much unlike each other both in shape and color. It is not proposed to enter into technical details as the figures shown are life size and have been drawn from nature. The female deposits her eggs, which are numerous, almost anywhere, and as Mr. Hudson remarks, quite indiscriminately, and the young larvæ have early to shift for themselves. They commence at once to eat into the bark of the trees attacked, but in the meanwhile many of these tiny grubs probably fall an easy prey to ants of many kinds which may be seen both by night as well as day crawling up and down the stems of our native trees in search of food.

In forest country, the dust-like swellings as shown on the plate may be noticed on various native shrubs as Hazel (*Pomaderris*), *Cassinia*, *Helichrysum*, and several species of *Acacia* and other plants, but until Mr. Grant made the important but unpleasant discovery that these grubs were destroying his apple trees, no one, so far as I am aware, had ever suspected that this moth would be added to our list of formidable orchard pests.

When a tree shows any sign of the oval-shaped swelling, shown in the plate, no time should be lost, as the larvæ tunnel quickly, and usually work downwards, and also remain for a long time in the wood.

It will be noticed by referring to the plate, that when newly emerged from the pupæ, these moths have the singular habit of clinging to a branch and suspending themselves therefrom. I have known the moth to remain for hours in the same position, leaving for flight when night came. I am pleased to be able to say that Mr. Grant, although surrounded by bush and bush insects has succeeded in stamping this pest out of his orchard. These moths, it may be mentioned, are rarely seen in daylight, and although supposed by many to be of rare occurrence, the insect is far from uncommon. In New South Wales, *Leto staceyi* has its home, and as this splendid moth is sometimes from 9 to 10 inches across the wings, and the grubs of a proportionate size, it will be readily understood what enormous damage is done by these to some of our finest timber trees. As to the apparent scarcity of this moth, I think it may safely be asserted that ants, of all other insects, are responsible for the task of keeping this and other pests within reasonable bounds.

Prevention and Remedies.

On page 114, Part I. of "*The Destructive Insects of Victoria,*" the following instructions for use against the Cherry-borer are given by me, and will suffice for this species also.

"Remove, or if possible have removed, all old and badly infested wattle and other trees growing in the vicinity of the orchard. Give the tree when dormant a spraying or two with either kerosene emulsion, tar water, Quibell's mixture, phenyle, or any other solution which would tend to make the flavour of the surface of the bark unpalatable for the female to rest upon for the purpose of depositing her eggs. After pruning, paint the stumps with a solution of tar and grease. Remove all loose bark, and daub with a common whitewash or similar kind of brush any of the solutions into the crevices or crotches of the tree; and to prevent the larvæ from descending from one tree and ascending another, a good plan would be to paint the lower portion of the stem with a mixture of kerosene, lime, tar, and grease.

When the presence of this borer is suspected, first clear away the sawdust-like matter before mentioned, the removal of which will indicate the direction taken by the grub, but as the holes are usually made in a horizontal position, the ordinary method of spraying should be somewhat departed from. If the spraying pump and nozzle be used, project, with as much force as can be commanded, the liquid into the hole, being guided by the direction taken by the grub.

In gardens where there are but few trees, small pieces of stick dipped into a mixture of tar and carbolic acid (three parts of the former to one of the latter) could be driven into the holes, which will in most cases, cause the grub to shrivel up at once and die. In large places this method would be, perhaps, too tedious, still the services of children might be utilized with advantage for this purpose, as the little sticks could be prepared by night around the family

fire; and any active boy could go over a large number of trees in a very few days. The little sticks, as also the solution, could be carried in an old billy-can in front of the operator.

As the grubs of this moth, if not destroyed, remain a long time in the trees (how long has not, I believe, been well ascertained) it will be all the more necessary to tackle them at once, as prevention is, after all, better than the cure.

The use of a lamp, such a one as is figured [in the book referred to], might also be tried with advantage in capturing the moths, both males and females, which, as a rule, are not numerous.

The forcing of steam into the holes made by this and other boring insects would, I feel certain, be of great benefit, and as the moth itself is not of a small size, and by its colour is somewhat conspicuous, there should not be much trouble in combating the ravages of this pest.

Old and abandoned orchards are fertile sources of infection, and should be carefully watched by growers and by all interested in fruit-growing as a profitable industry."

Explanation of Plate.

"Apple-tree Hanging Moth."

(*Charagia lignivora*), Lewin.

Fig.

1. Apple-branch showing larva in bore, also covering partially removed.

1a. Covering of young larva, burrow.

2. Pupa.

3. Perfect insect, female.

4. ,, ,, male.

5. ,, ,, ,, at rest.

TWO NEW FUNGI PARASITIC ON SCALE INSECTS.

By D. McAlpine.

Insect-destroying Fungi.

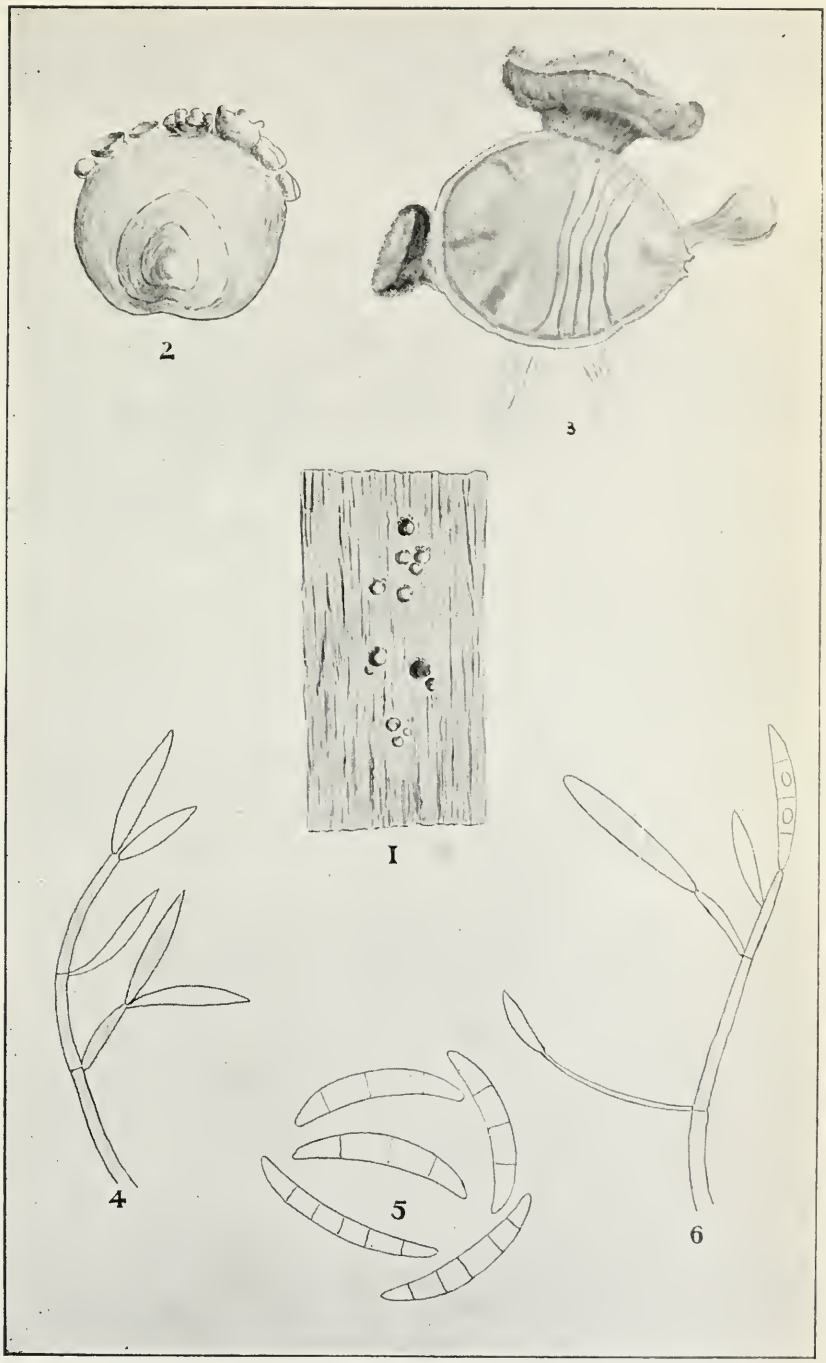
In recent years considerable attention has been devoted to the study of the fungi parasitic upon insects, and especially because of the possibility that some of them may be pressed into service for destroying insects injurious to crops and trees. In the January *Journal* some particulars were furnished of a parasite of the codlin moth and now descriptions are given of two new species, belonging to the genus *Microcera*, parasitic on scale insects. Of these two species, one has been found upon a scale infesting a Eucalyptus in Tasmania, and the other upon a similar parasite of the scrub box-wood (*Hymenanthera dentata R. Br.*) Though neither of these have been met with upon the scales injurious to our fruit trees, it is still possible that one or the other may be induced to attack some of these. We know so little about these fungi at present that until further opportunities for their study are afforded we can only point to the possibility of their usefulness, and instance a closely related species which has done good work in combating the San José scale in parts of America.

Professor P. H. Rolfs, [1] of the Florida Experiment Station, in 1897 first brought under notice this closely related species (*Microcera coccophila)* as a vigorous and effective ally in checking the destructive San José scale. He was able to infect the scale with the fungus and thus to spread the disease.

Then S. A. Forbes [2] State Entomologist of Illinois Agricultural Experiment Station, in 1898, carried out a number of inoculations and was able to report as follows :—" As a result of this field-work with the above-mentioned fungus disease of the San José scale it is evident that the distribution of *M. coccophila*, under conditions prevailing in southern Illinois this year, is likely to prove a valuable adjunct to more energetic measures for the destruction of this insect. Indeed, we may go so far as to say, that if the scale should finally become a permanent resident of this State, it is quite possible that this and similar enemies will form a permanent check upon its multiplication, such as to reduce its injuries to comparative insignificance." This species is not only common in Europe and America on various scales, but was reported from Queensland by F. M. Bailey, Government Botanist of that State, upon a scale of the lemon, and later J. H. Maiden, Government Botanist of New South Wales, forwarded to me numerous specimens upon the red scale of the orange

1. Florida Experiment Station, Bull. 41 (1897).

2. Illinois Agricultural Experiment Station, Bull. 56 (1899).



C. C Brittlebank, del.

A FUNGUS PARASITE ON A SCALE INSECT

(*Microcera tasmanica McAlp*)

(*Aspidiotus coccineus*). Seeing the great variety of scales upon which this species is found it seems by no means improbable that one or other of the new ones here recorded may be found to possess some economic importance. I hope to be in a position to carry out cultural experiments with both of these fungi, and so test their practical value in the destruction of scale insects. No benefit is likely to accrue from haphazard methods, hence careful study and investigation must go hand in hand with the provision of the necessary facilities for work of this nature.

The Tasmanian Species.

The first of the new species was kindly sent to me for naming by Mr. A. M. Lea, Government Entomologist of Tasmania, upon an undetermined scale of a Eucalypt. It appears in the form of small pink tufts protruding from beneath the scale, and continues its growth even after the bark is removed from the tree, as a number of these pink tufts developed on the specimens sent from Tasmania when kept moist, thus showing how readily it might be propagated.

The technical description is as follows :—

Microcera tasmaniensis n. sp.

Conspicuous salmon-pink tubercles of cheesy consistency, either globose or cup-shaped, shortly stalked or subsessile, generally confluent in irregular masses and enveloping scale-insects, 1-1½ mm. in extent.

Conidiophores pink in the mass, hyaline separately, branching unilaterally or alternately or often bifurcating, bearing conidia at apex of each branch, 2½ microns* broad. Conidia hyaline, fusiform, generally curved, 3-septate, not constricted at septa, 40-45 × 5½-6 microns.

On *Aspidiotus sp.* on Eucalyptus bark. July 1901. Tasmania (Lea).

It differs from *M. coccophila* in the conidia being 3-septate and only about half the length and in the spore-tufts being salmon-pink instead of deep brick-red. I am indebted to Mr. C. C. Brittlebank for the drawings which are reproduced in the first plate.

The Victorian Species.

The second species was collected by Mr Chas. French, Jnr., on mussel-scale infesting the scrub boxwood near the Yarra at Ivanhoe. The bright pink tufts or tubercles were exceedingly numerous on many branches, nearly every scale being attacked so that the affected shrub was a very conspicuous object.

Microcera mytilaspis n. sp.

Spore-tufts bright salmon-pink, fleshy or waxy, pulvinate, confluent in irregularly rounded or elongated disciform tubercles 1-2 mm. diam. surrounded by barren filaments which separate at the top so as to expose conidia. Conidiophores pink in mass, hyaline individually, septate, 2-3 microns broad, very long and branching mostly unilaterally and bearing conidia at apex.

Conidia hyaline, fusiform, curved, acute at both ends, 5-6 septate at maturity, not constricted at septa, 45-60 × 5-6 microns.

On scale on *Hymenanthera dentata R.Br.*

This differs from all the described species in the size and septation of the spores.

* A micron is approximately $\frac{1}{25000}$ of an inch.

The photographs of this species in the second plate were made by Mr. G. H. Robinson.

Sections of this fungus show that the disciform body consists of an envelope of barren filaments, at first completely enclosing the conidiophores, then, as the conidia ripen, these filaments gradually separate at the top and expose the layer of conidia. At the base of this reproductive disc the filaments are united into a short stalk arising from the fungus-filaments which have replaced the body of the insect. The mycelium of the fungus at first withdraws nourishment from the insect until all the soft substance is used up and replaced by it, then the reproductive bodies are produced which propagate the fungus.

Explanation of Plates.

Microcera tasmaniensis McAlp.

Fig. 1.	Piece of Eucalyptus bark showing scale insect attacked by fungus	× 2
,, 2.	Test of scale insect with fungus	× about 30
,, 3.	Insect with test removed and showing shortly stalked fungus at margin	× about 50
,, 4.	Branched conidiophores bearing terminal conidia ...	× 540
,, 5.	Mature conidia detached	× 540

Microcera mytilaspis, McAlp.

,, 6.	Small branch of *Hymenanthera dentata R. Br.* with species of mussel-scale (*Mytilaspis*) destroyed by the fungus	(natural size)
,, 7.	Cross-section of branch showing growth of fungus from beneath the scale	× 75
,, 8.	Cross-section at a later stage showing disc-like shape of fungus	× 75

THE ORCHARD.

By Jas. Lang.

The gathering of the fruit now being finished, it is necessary to get ready for the winter's work. When gathering the fruit note should have been made of worn-out or worthless varieties of fruit trees, with a view to heading them back in the spring, and regrafting with more suitable kinds where the stock is healthy and free from disease. In this way old, healthy trees can be given a new lease of life, and produce fruit more adapted to the requirements of the market.

New Plantings.

Where it is intended to make new plantations of fruit trees the ground should be broken up at once, as early planting is always to be recommended. Lists of the best varieties of fruits to plant were given in the July (1903) number of the *Journal.*

Citrus Fruits.—Now is a good time to plant citrus trees, as, the ground being warm and moist, they take root at once, before the cold of winter sets in. The old Lisbon lemon is still one of the best to plant, and does well south of the Dividing range. Oranges require a hotter climate than lemons, and succeed well in the warmer parts of the State.

Strawberry plantations, if now made, take root at once, and where strong plants are put out a fair crop may be had the first season.

Draining.

The draining of orchards is a matter that does not receive the attention that its importance demands. In most districts where there is a heavy rainfall it is essential that the ground should be drained. Where orchards are drained it is more easy to combat the various fungus diseases that attack fruit trees, while a more healthy and vigorous growth is promoted. Drains should be not less than two and a half feet in depth, and laid with the ordinary draining tile. Two and a half inches in diameter is a good size. Where tiles cannot be got, stone broken like rough road metal may be used, a depth of one foot being put into the drain; this will last for years without choking.

Insect Pests.

The codlin moth bands will require to be removed and scalded, dried, and put away ready to be put on again next spring. Scrape all loose bark from the trees and fill up with putty any holes or crevices in old trees, which lessens the hiding places of the grub, and tends to reduce the number.

The past summer being very moist, the mussel scale has made more headway than usual in old orchards, and affected trees should be dressed with some insecticide to check its progress, such as the lime, salt, and sulphur wash used in California: Unslaked lime, 40 lbs.; sulphur, 20 lbs.; salt, 15 lbs.; water to make 60 gallons.

To Make the Lime, Sulphur, and Salt Wash.

Place 10 lbs. lime and 20 lbs. sulphur in a boiler with 20 gallons water and boil over a brisk fire for not less than an hour and a half, or until the sulphur is all dissolved. When this takes place the mixture will be of an amber colour. Next place in a cask 30 lbs. of unslaked lime, pouring over it enough hot water to thoroughly slake it. When it is boiling add the 15 lbs. salt, and when this has dissolved add the lime and sulphur to the contents of the boiler and cook for half an hour longer, when the necessary amount of water to make up 60 gallons should be added.

G. H. Robinson, Photo.

A FUNGUS PARASITE ON A SCALE INSECT

GARDEN NOTES.

By J. Cronin.

Flowers and Shrubs.

The principal work during May and June in established gardens is pruning, clearing, and digging beds and borders, planting, and preparation of soil for future cropping.

Herbaceous plants and annuals that have finished flowering should be cut down, and the tops be either dug in, added to compost heap, or burned. Stools of chrysanthemums should be lifted and sufficient suckers selected for planting next spring, those of moderate and firm growth being best adapted for the purpose. Dahlia tubers should be lifted as soon as the tops have died off, and stored in a dry, cool place, away from the influence of frost. Dahlias have been badly affected by red spider during the season just past, and all litter from them, and other plants similarly effected, should be collected and burned. Pruning of roses should be commenced generally during June, if wood is ripened, and cuttings may be then inserted, those with a heel from a previous break being preferable. Where specially fine blooms are desired a heavy dressing of cow manure should be dug into the beds, and if the soil is sandy a dressing of heavy loam or clay also.

Bulbs of various winter and spring flowering species, such as Narcissi, tulips, hyacinths, &c., may still be planted, but no time should be lost in so planting, as many of the different kinds are starting growth. The excessive rainfall of the past spring and early summer caused the death of quantities of plants of all kinds in those gardens that were not thoroughly drained. This want of drainage should be attended to at once, and where drain-pipes (through added freight rates) are expensive the best draining material is charcoal.

Mr. Gowling, manager of Judge Holroyd's Wandin estate, has drained a portion of the property, using charcoal, with the result that trees and shrubs that were dying owing to excessive moisture at the roots, have completely recovered, and are now healthy and vigorous.

Where wood is abundant, as it is in most country districts, the cost of such material for draining would be very slight, and would well repay the gardener for the time and trouble, or expense of charring, as, in addition to its superiority as a drainage medium as compared with wood as commonly used, its chemical action on the soil ensures a healthy growth on all plants. All drains should be at least six inches into the clay soil.

Deciduous trees and shrubs may be planted during June, and in the more elevated districts a fine autumnal effect may be produced by the selection of those whose foliage becomes coloured before falling.

Of such, the American oaks, *Quercus palustris* and *Q. coccinea*, maples of various species and varieties, *Rhus typhina, R. laciniata, R. succedanea,* and *R. Osbeckii, Viburnum opulus* (Guelder rose), and the various forms of *Ampelopsis* and *Vitis* (climbing) are specially suitable. A point in favour of the American oaks is that they are not liable to attack by the oak scale (*Planchonia*).

Vegetables.

In the kitchen garden early varieties of peas and broad beans should be sown.

The best early market pea is Day's Sunrise, quantities of which are usually grown in the heavy, loamy soils near Melbourne. It is always first in the market, and usually commands good prices. Yorkshire Hero is the next in succession, and is generally the best main crop pea. Early peas should always be staked, as they are thus less liable to be affected by frost and fungus diseases.

Celery should be earthed up some time before it is required for use. A dressing of manure and salt should be forked into asparagus beds.

Potato and tomato haulm, cabbage and cauliflower leaves, and all refuse from plants affected by rust or spot should be burned.

A TICK PROOF FOWLHOUSE FOR INFESTED TOWNSHIPS.

By A. A. Brown, M.B., B.S.

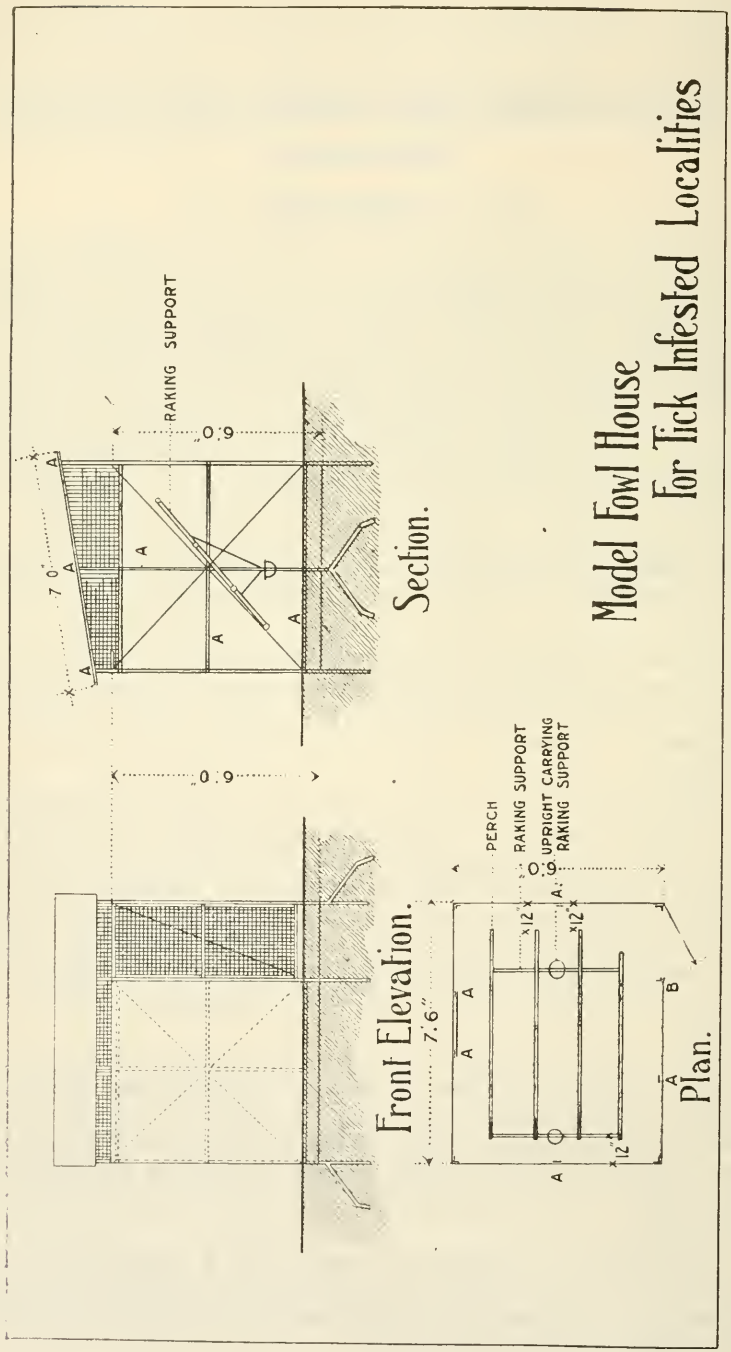
The plan, section, elevation, and sketch view have been prepared by the Public Works Department, and the details of construction are as follows:—All the corners C as shown on plan should be constructed of $1\frac{1}{4}$ in. × $1\frac{1}{4}$ in. angle irons split and forked at bottom and the uprights A in centre of each side, and those carrying roof marked A on plan and section should be 1 in. × $\frac{5}{16}$ in. wrought bar iron, and the whole structure should be properly bolted together with $\frac{1}{4}$ in. bolts, so as to be capable of being readily taken to pieces. The door frame should also be constructed of 1 in. × $\frac{5}{16}$ in. wrought bar iron and riveted together and covered with inch mesh wire netting hung with hook and eye hinges, and furnished with approved latch. The cross bracing (as shown on section and elevation) on all sides should be made on No. 6 gauge fencing wire.

The whole of the outside of the walls and roof should be covered with 26 gauge galvanized corrugated iron secured to horizontal bars on sides and roof framing with approved clips at sides and centres of each sheet at each rail, and the sheets at angles should be bent round same, and all sheets on sides and roof should have a lap of one corrugation.

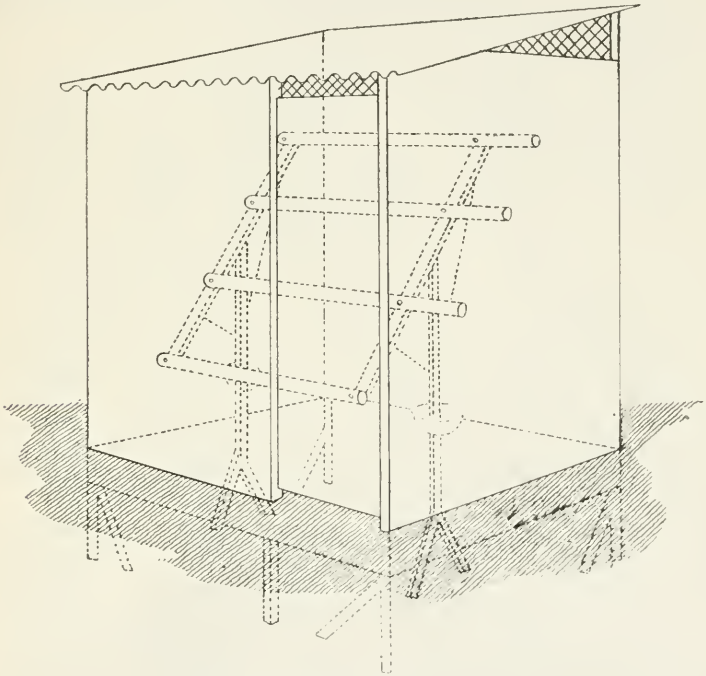
The raking support or stand as seen on section at B forming the perch should have two uprights formed of angle iron similar to corners and 1 in. × $\frac{5}{16}$ in. arms and brackets, the whole bolted together. The perches should consist of 3 in. diameter kauri pine, tarred, and supported on rests, so as to be capable of easy removal. The cups shown on uprights supporting perches should be made of metal and strung round the uprights and soldered to them. The cups should contain solutions of either formalin or phenyle, or kerosene.

In the centre of the back of the shed one sheet of iron is to be so fixed with bolts as to allow of its easy and complete removal and replacement when desired in the summer, so that the sun's rays may be able to reach every part of the shed. This space (including the upper portion of sides of shed) should be filled in with inch mesh wire netting, so that when the sheet is removed the wire netting fills the opening.

The sketch on the following page gives a general idea of the construction of the building, and it should be erected to face the east, and will accommodate about 30 fowls, and if entirely constructed as described will cost about £12.


Model Fowl House
For Tick Infested Localities
Front Elevation.
Section.
Plan.
RAKING SUPPORT
PERCH
RAKING SUPPORT
UPRIGHT CARRYING
RAKING SUPPORT
6'0"
7'0"
7'6"
12"

For durability and efficiency corrugated iron is recommended in the construction, but ruberoid, which is a little cheaper, could be used; sheets of corrugated iron 8 feet by 2 feet cost 2s. 9d. per sheet, and ruberoid is 24s. 6d. a roll of 72 feet by 3 feet and 1 ply thickness. Uralite is more serviceable than ruberoid; it is fire-proof, and is made in strips 6 feet long by 3 feet wide and $\frac{1}{9}$ inch thick, and is $4\frac{3}{4}$d. a square foot, so each sheet costs a little over 7s. It is a good material, but its cost may perhaps preclude its general use, since it is twice as dear as corrugated iron.



General View of Tick proof Fowl House.

Instead of enclosing the sides with corrugated iron, the building could be rendered dog and fox-proof by filling in the sides with wire mesh netting, and if that be done the cost of erection would be materially reduced; and in winter canvas awnings could be placed in position to protect the fowls from cold winds. The iron supports, iron roof, and iron raking perch, protected by the cups, are the essentials in the construction to protect the fowls from infestation by tick. The building should be painted white with Arabic paint, which would tend to keep it cool in summer.

In the next issue of the *Journal* will appear a description of a cheap tick-proof fowlhouse for farmers

EGG PRODUCTION FOR PROFIT.

By A. Hart.

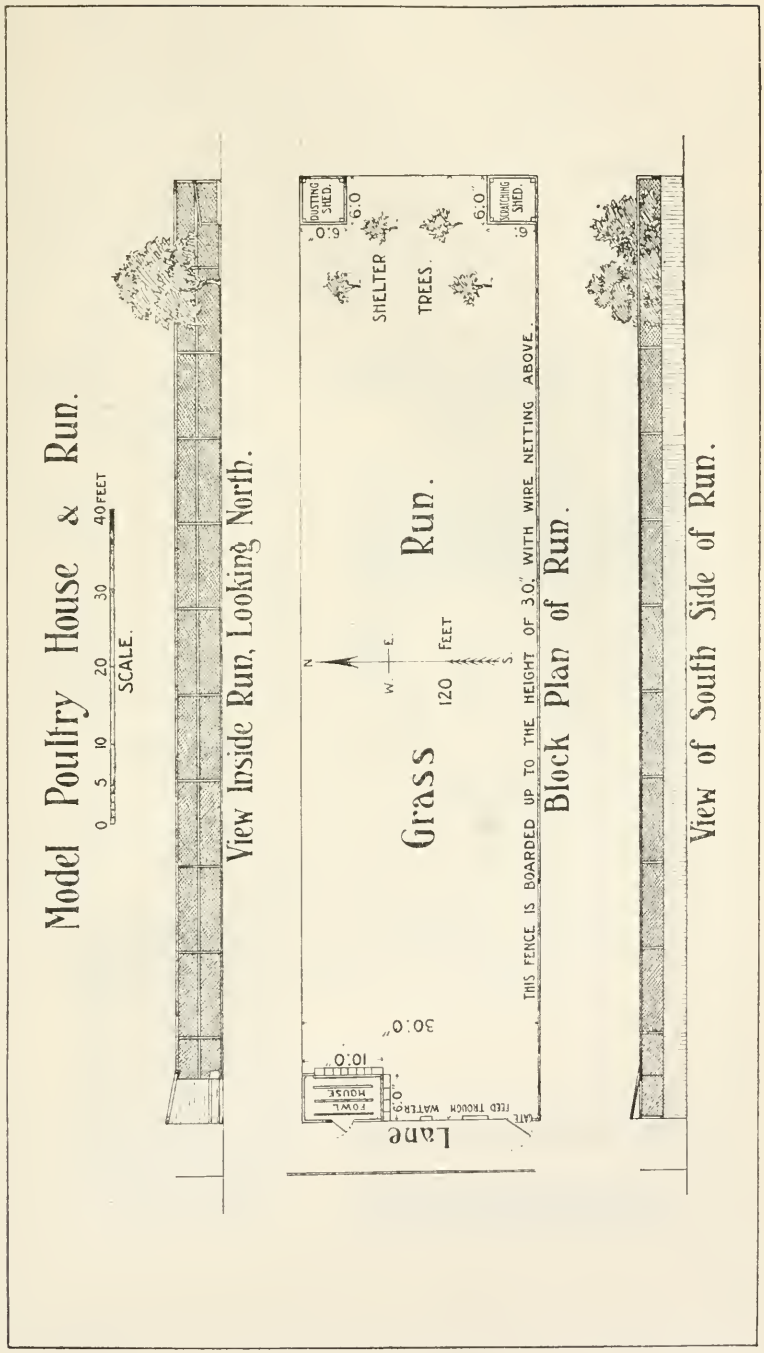
Egg production is a branch of the poultry industry which can be practised either by the breeder who has an extensive poultry run or the suburban resident who has only a limited space at his disposal. Special inducements for poultry keeping are to be found this season in the very low prices of grain, pollard, and other foods, and the fairly remunerative price of eggs.

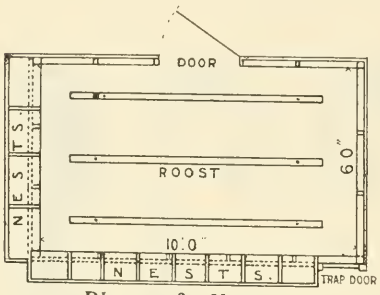
In starting a yard of fowls for egg production it is wise to select stock from the best laying breeds or strains, and Leghorns are a breed that can be specially recommended for the purpose. There are several varieties of them including brown, white, black, buff and pile. The two first-named are by far the most plentiful and may be purchased at a reasonable figure. During the past two years a number of rose-combed specimens have been introduced from America as an addition to our single-combed birds. The excellent records of these birds in the laying competition at the Hawkesbury College, N.S.W., have brought them prominently before Australian poultry keepers. Both whites and browns have scored premier honors in these competitions and their average of 190 eggs per bird for 12 months is certainly a strong argument in favor of the rose-combs. These results were, no doubt, accelerated by the suitable conditions under which the birds were kept, as correct feeding, housing, and attention have much to do with success in poultry keeping.

In starting a yard of, say, 50 fowls for egg production, the months of May or June can be recommended as a suitable time to begin. A run 120 feet by 30 feet will be a handy size, and it should be broken up and sown with prairie or rye grass, allowing the growth to be fairly strong before letting the fowls on it. In choosing the ground let the fall be to the east if possible, and see that it is well drained. The run should be enclosed with wire netting, and if palings 2 feet 6 inches high are used for the bottom it will make the run much more sheltered. Trees should be planted for shade and protected until they are a fair size.

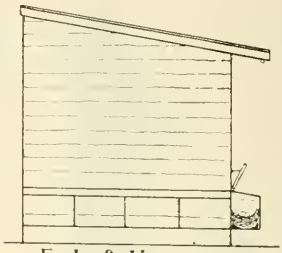
The fowl-house should be at one end of the run and can be constructed on the lines shown in the illustrations, and must be facing the east. Slope the roof towards the front and allow it to project a foot over the wall plate. Spouting should be fixed to carry off the water. The walls should be closed on both ends and back and the top portion of the front may be covered with wire netting 2 feet wide, the remaining portion being closed. Perches should be placed about 18 or 20 inches from the ground, fixed on a vermin proof frame according to model. A row of nest boxes should be constructed along the front of the house on the outside, allowing the hens to enter them from the fowl-house. The top of

PERSPECTIVE SKETCH OF POULTRY HOUSE AND RUN

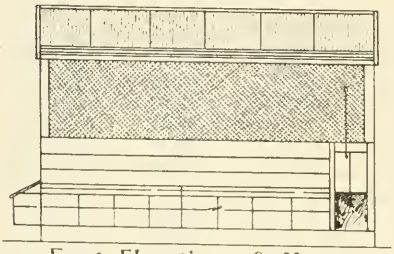

Model Poultry House & Run.
0 5 10 20 30 40 FEET
SCALE.
View Inside Run, Looking North.
DUSTING SHED.
6.0"
6.0"
SHELTER
TREES.
6.0"
SCRATCHING SHED.
6.0"
Grass Run.
N
W
E
S
FEET
120
THIS FENCE IS BOARDED UP TO THE HEIGHT OF 3.0" WITH WIRE NETTING ABOVE.
30.0"
10.0"
POWL HOUSE
6.0"
FLAT FLED TROUGH WATER
Lane
Block Plan of Run.
View of South Side of Run.



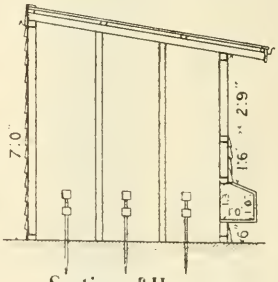
Plan of House.



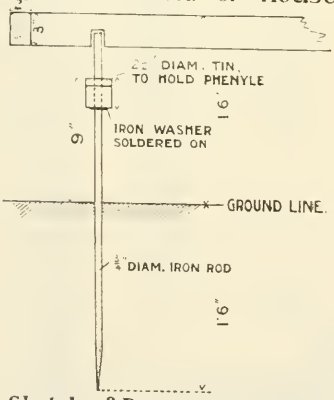
End of House.



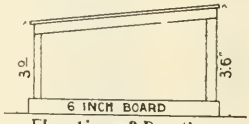
Front Elevation of House.



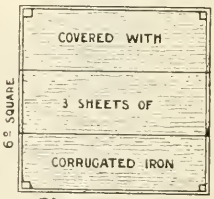
Section of House.



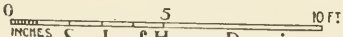
Sketch of Roost, to larger Scale.



Elevation of Dusting & Scratching Sheds.



Plan of Same.



Scale of House Drawings.

the nest boxes should be hinged and the eggs can then be collected easily. Provide shelter at the opposite end of the run. One corner may be used as a dust bath, and a roof about 6 feet square will be sufficient cover. A frame about the same dimensions and 6 inches high will form the dust bath, which can be supplied with a mixture of wood-ashes and sand and a little sulphur. The scratching shed can be about the same size, and a few loads of short straw or stable litter on the floor will answer the purpose required.

A male bird need not be placed with the hens when the eggs are not required for setting. They will keep much better if not fertilized, and the hens will also produce more eggs.

To obtain best results from your hens, feed on the following lines :—Morning meal, one half pollard, quarter bran, and quarter lucerne chaff or green food chopped fine, mix dry and add enough boiling water or separated milk to moisten the whole. A wooden trough, 2 feet 6 inches by 4 feet, and 8 inches high, the front set at an angle of 40 degrees to allow the spade to be freely used in mixing, will be found of much benefit. This trough will allow the food to cool quickly, if required. For mid-day and evening meal heavy Algerian oats may be given and a handful to each bird for the latter meal and about half the quantity for the mid-day. Wheat may be used alternately, giving a slightly less quantity. In the winter months maize can be given occasionally, taking care to stop it altogether if the birds are in too high condition. When birds become too fat increase the supply of green food. Green cut bone will increase egg production, and about 2lbs. of fresh cut bone may be given twice a week to 50 fowls. It contains the necessary ingredients for egg formation, and should be regularly used as directed during the winter months when the weather is cold and insects, worms, etc., cannot be obtained. Troughs should be used for feeding purposes, and a plentiful supply of green food, if necessary. Fresh and pure water should be always available, and a plentiful supply of grit should be always at hand.

Warmth tends to increase egg production, and both houses and runs should be specially regulated in this respect.

A TICK-PROOF FOWL HOUSE.

By H V. Hawkins.

In the tick infested areas of the North of Victoria poultry breeders have been very seriously handicapped, because it has been almost impossible for them to add to their already small stock. The late drought which made feeding a costly matter tended to reduce the number of fowls kept, and worse still, it gave the ticks an opportunity of breeding in large numbers, as undoubtedly they do in dry seasons. At the present time it is next to impossible to rear young stock.

This prompted the Director of Agriculture to send me on a visit of inspection, and, at the same time, to try an experiment which I had previously recommended to the students at the Farmers' Classes to eradicate this pest. It would not be out of place to briefly explain the method adopted, which proved successful.

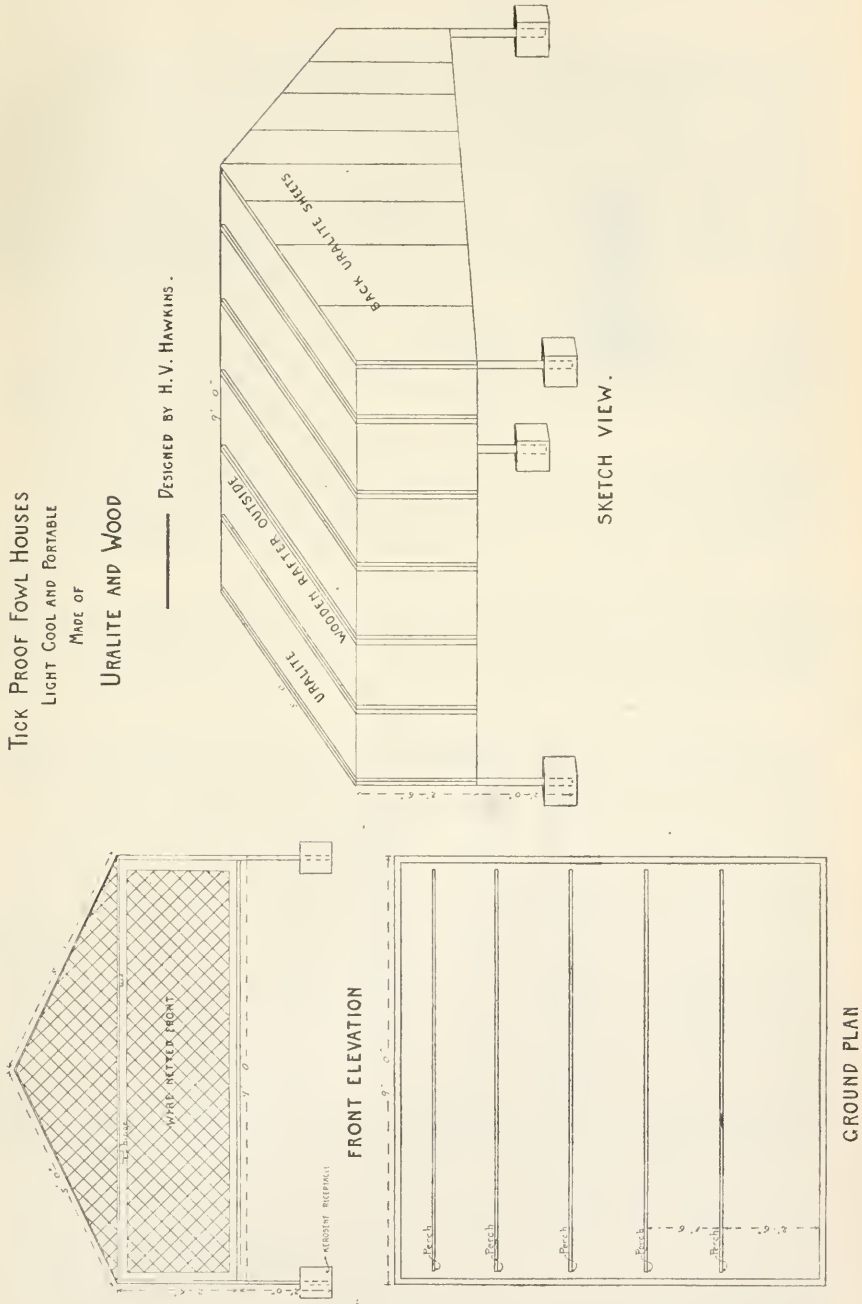
An Ætna lamp, used by plumbers for brazing purposes, was the main feature in the destruction of the ticks. Added to this machine was a tray, immediately under the flame, carrying a sulphur candle, the fumes of which as they rise are immediately carried forward with the flame and penetrate all cracks and crevices, and thus many thousands of ticks are destroyed.

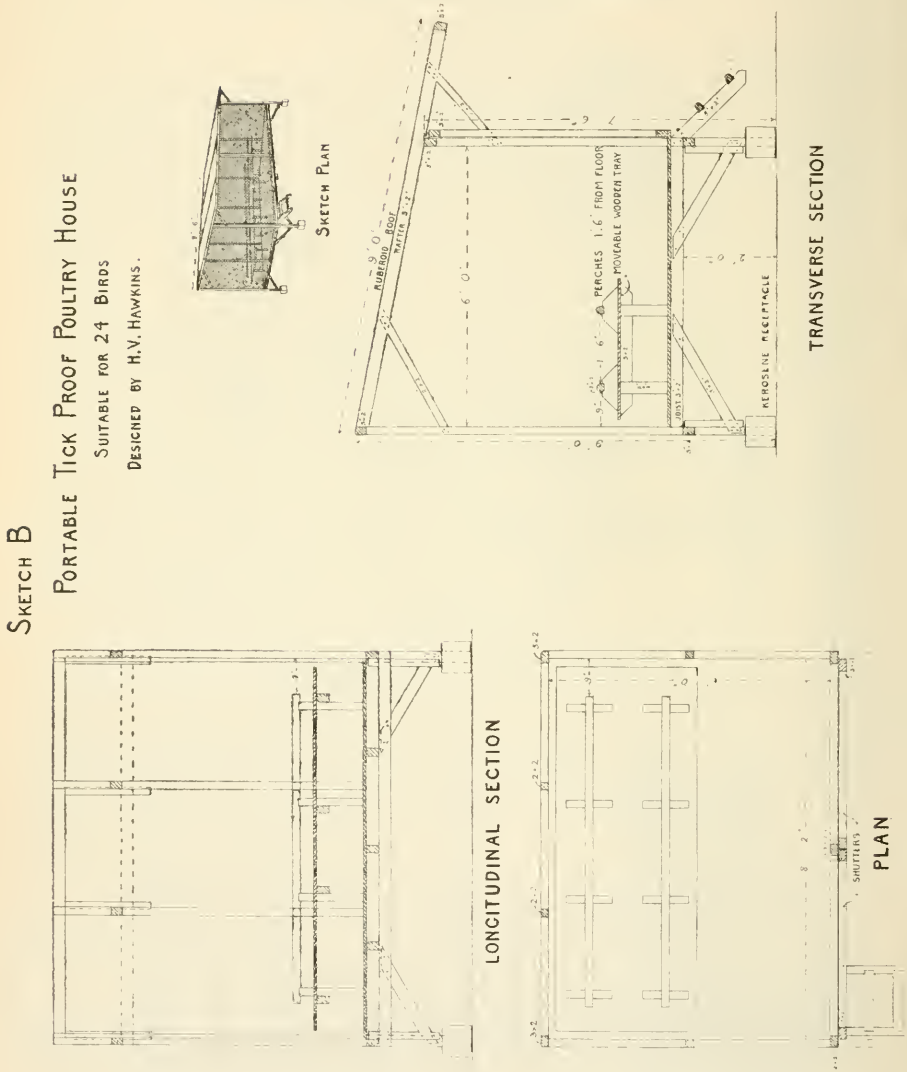
The greatest difficulty experienced during the experiments was in getting at the ticks, which made their hiding place between the heavy joints of the fowl houses. This necessitated the use of a crowbar to ease joints, so that the flames could more readily attack the parasites. It was found, in many cases, that nests of ticks' eggs were laid in between pieces of cracked timber thereby making the job a tedious one, showing it is a mistake to build fowl houses with such heavy material, and more so when such timber has many cracks for the pests to gain cover.

To effectively cope with this, the fowl's worst enemy, I recommended that the old houses should be absolutely destroyed, as it would be quite impossible to make them tick-proof.

It would pay the farmer handsomely to re-start breeding poultry on sound lines, and at a little outlay. The accompanying plans were drawn with one object, to afford a safe guide to the erection of a fowl house proof against the tick, and are worthy of careful consideration.

It will be observed that the house in sketch A is constructed of a light material, uralite, which is nailed on the inside of a light wood frame, so that there are no wood cracks or joints to harbor insects, the uralite fitting close. The only wood seen inside is the floor, which is raised two feet from the ground, having four legs to support the whole. These legs, it will be seen, are standing in receptacles which


SKETCH A
TICK PROOF FOWL HOUSES
LIGHT COOL AND PORTABLE
MADE OF
URALITE AND WOOD
DESIGNED BY H. V. HAWKINS.
URALITE
WOODEN RAFTER OUTSIDE
BACK URALITE SHEETS
SKETCH VIEW.
WIRE NETTER FRONT
KEROSENE RECEPTACLE
FRONT ELEVATION
Perch
Perch
Perch
Perch
Perch
GROUND PLAN


SKETCH B
PORTABLE TICK PROOF POULTRY HOUSE
SUITABLE FOR 24 BIRDS
DESIGNED BY H.V. HAWKINS.
SKETCH PLAN
RUBEROID ROOF
PERCHES 1.6' FROM FLOOR
MOVEABLE WOODEN TRAY
KEROSENE RECEPTACLE
TRANSVERSE SECTION
LONGITUDINAL SECTION
SHUTTERS
PLAN

are partly filled with kerosene, thereby preventing any crawling insects from reaching the birds at night as is usual with all fowl vermin.

Another feature of this house is the perch, which is three inches wide, thereby preventing the birds from getting crooked breasts. The perches are quite loose, merely resting on three chips of uralite which are nailed to the wall. These perches should be removed weekly, and examined, not only for the ticks (which may occasionally get in on the birds) but for the red sucker, which plays havoc with poultry in all districts. Any signs of small white dots on the perches should be immediately washed over with kerosene, as these small white eggs will hatch in a very short time (the ticks' eggs are red).

It is claimed for the house :—

1st.—That it is fire-proof. (The brazing lamp may be used without any fear of fire, as uralite will stand 3,000 degrees of heat, sufficient to melt steel.)

2nd.—That it is tick-proof.

3rd.—That it is much cooler than any other building material used in constructing fowl houses.

4th.—That by dropping the wire door at night time it is fox-proof.

5th.—That the house being portable may be turned according to weather conditions, thereby saving the birds from the ill effects of driving wind or rain. Let the opening of the house face the east, excepting when an easterly wind or rain sets in, which is seldom in Victoria.

Lastly, the raised floor of the house affords good shelter for the birds during the heat of the day.

The cost of uralite is a trifle more than galvanized iron, but it will amply repay the additional cost.

Sketch B will enable the reader to see at a glance how to construct a smaller house capable of housing, say, 25 birds. It also may be built of uralite on the inside of a wooden frame, which is the most desirable arrangement, thus securing the advantages mentioned in regard to sketch A; or it may be built of ruberoid stretched over wire netting placed over the wooden frame. The overlapping joints of the ruberoid should be sealed with ruberine and fastened with special studs supplied with the material by the makers. Of course, it may be built of wood and iron in the usual way, but this is not recommended. This house also is tick-proof, and is easily portable as two lads can lift it. It has the advantage of having a flap or verandah preventing rain from driving in; it also stands in kerosene tins, or any receptacle sufficient to hold a little kerosene. The front, which should face the east, is simply a wire shutter, preventing foxes or dogs from interfering with birds.

The perches in the house shown in sketch A may be adopted in the house shown in sketch B; or the special arrangement

shown in B may be adopted, if desired, viz., a movable wooden shelf under the perches to catch droppings. House "B" would take a third perch, if necessary, and would then accommodate at least 30 birds. In both A and B the kerosene receptacles in which the legs of the houses stand should be fairly deep, and only partly filled so that the birds may not be able to get at the kerosene.

The approximate cost of the material for house A built of uralite as shown would be £5 10s.

House B would be less; and both would be less still if built of ruberoid. The difference between the cost of wood and iron and uralite is not great.

GENERAL NOTES.

The Orizaba Butter Shipment.

Since writing last mail the R.M.S. "Orizaba" with 15,678 boxes of butter has arrived in dock. The chambers in which the butter had been carried had apparently been kept at a very low temperature, the butter at the time of discharge ranging between 10 and 20 degrees Fahr. The last few consignments have been delivered at a much colder temperature than the shipments which arrived during November and part of December, and there have been fewer complaints lately respecting the "fishy" flavour in the butter. A few of the brands are still affected, but the flavour is not so pronounced as was the case in the earlier shipments. This would seem to bear out the opinion expressed in my memorandum of the 18th December, that the "fishy" flavour is more quickly developed when the butter is carried at 35 degrees temperature, than would be the case in butter ranging between 15 degrees and 25 degrees or even lower. I take this opportunity of again pointing out that the New Zealand butter is being carried below 10 degrees.

It may be of interest to know that during December, 1903, Australia was second on the list of countries exporting butter to this country. The chief figures are :—

Denmark	150,114	cwts.
Australia	57,875	,,
France	38,653	,,
New Zealand	30,939	,,
Holland	23,755	,,
Sweden	16,844	,,
Russia	15,982	,,
Argentine	10,412	,,
United States	3,812	,,
Canada	3,727	,,

—*A. G. Berry.* (*R. Crowe*).

The American Apple Crop.

There are as yet no reliable statistics as to the apple crop for 1903, but it is reported that there has been a shortage of nearly 1,000,000 barrels as compared with 1902, when the amount was given as 4,214,800 barrels. The value of the crop last year was far greater than in many previous years, and this condition was largely due to the experiments which have been made by the Government to determine the best mode of culture, handling, and care in cold storage. The consumption in this country has of late years greatly increased, and the exports for 1903 were phenomenal, and prices were far higher than in any previous year. Cold storage has been of the greatest benefit to the small farmer, who can reap a valuable harvest by raising poultry and apples, which do not require such a great extent of land as is necessary for a profitable raising of cereals.—*Ice and Cold Storage.* (*R. Crowe*).

Eggs in Cold Storage.

The year just closed has been a banner year for eggs in cold storage, and more money has been made by the holders than in any previous year since the establishment of refrigeration for the care of perishable products. From April last and during the summer, about 4,000,000 cases of eggs of 30 dozens each have gone into the cold rooms, and, although the price paid was higher than ever before, the profits have been phenomenal. The poultry industry in this country is hardly appreciated as to its enormous proportions by the general public. It is estimated that the poultry and eggs produced annually in the United States are of greater value than all the gold and silver mined in the world during the same period. The latest table gives the value of fowls on the farms at £1,715,880. The number of chickens is estimated at 250,000,000. The market value in one year is £27,200,000. The eggs produced are worth £28,800,000 giving a total valuation of £56,000,000 which represents an income of 400 per cent. on a similar investment. The incubators have been worked overtime to provide poultry for the market, and the hen has devoted her time to the production of eggs for the incubators, and to supply the ever increasing consumption. It is estimated that in one year there have been produced on the farm 43,127,000 cases of eggs of 30 dozens each. It is further estimated that 60,000,000 cases of eggs were produced in this country during the last year, and that there has been for 20 years an annual increase of more than 5 per cent., with a prospect of a still greater percentage during 1904. Cold storage is responsible for this enormous production and consumption of eggs, and the methods of handling and storing are continually being improved. The charges for storage may be given as an average of 15 cents per month per case of 30 dozen eggs. January 1st is considered to be the end of the egg storage season, and goods carried after that date have heretofore been held at a loss. This last year there was practically no stock left in the coolers on January 1st. Under these conditions the price of eggs has been abnormally high, and it remained for far-distant Russia to break the market. This was done last week, when 450 cases of eggs arrived from Hamburg, where they had been held in cold storage, having originally come from Russia. The severe cold weather in the South has greatly delayed the supply of eggs, which is generally in evidence after the 1st January, and although a train load was started for New York during the recent cold snap, the goods were badly frozen before arriving at their destination.—*Ice and Cold Storage.* (*R. Crowe*).

Prussic Acid in Sorghum.

Sorghum has long been suspected of possessing poisonous properties when fed to cattle in an immature state. Recent researches by Dunstan and Henry (*Imperial Institute Report,* 1903) show that prussic acid is formed in the plants in the early stages of growth, but that the quantity becomes lessened as maturity approaches until, with the ripening of the seed, it disappears entirely. Many farmers have

asserted that sorghum is only injurious in the young state, and these researches now furnish the proof. The method of avoiding loss is obvious, feeding the plant to cattle only after the flowering stage is passed.

Nitrogen-Fixing Bacteria.

Since the publication in the March issue of the *Journal* of the paper on this subject by George T. Moore, of the U.S. Department of Agriculture, cultures of these organisms have been received together with additional information, and experiments are being conducted to test their utility in this State.

In some quarters misapprehension has arisen as to the method of employing these organisms, farmers even having written for a special brand adapted for use with oat crops. It must be clearly understood that the organisms are not beneficial to all farm crops, but only in connection with leguminous plants such as peas, beans, lucerne, clover, vetch, &c. The organisms cause the formation of nodules on the roots of these plants, and appropriate the nitrogen of the atmosphere for the use of the plants. Even with legumes these bacteria are of no decided benefit except when the proper nodule-forming organisms are lacking in the soil, but a crop of legumes with the nodule-forming bacteria improves the soil for succeeding crops.

Cultures have been received for lucerne, cowpea, soy bean, and vetch, and experiments are being conducted with these by the Pathologists' branch, but no material is this season available for distribution to farmers. The method of employing the cultures is given as follows:—

Put one gallon of clean water (preferably rain water) in a clean tub or bucket and add No. 1 of the inclosed packages of salts. Stir occasionally until all is disolved.

Carefully open package No. 2 and drop the inclosed cotton into the solution. Cover the tub with a paper to protect from dust, and set aside in a warm place for 24 hours. Do not heat the solution or you will kill the bacteria—it should never be warmer than blood heat.

After 24 hours add the contents of package No. 3. Within 20 hours more the solution will have a cloudy appearance and is ready for use.

To Inoculate Seed.—Take just enough of the solution to thoroughly moisten the seed. Stir thoroughly so that all the seeds are touched by the solution. Spread out the seed in a shady place until they are dry enough to handle, and plant just as you would untreated seed.

To Inoculate Soil.—Take enough dry earth so that the solution will merely moisten it. Mix thoroughly, so that all the particles of the soil are moistened. Thoroughly mix this earth with 4 or 5 times as much, say half a wagon load. Spread this inoculated soil thinly and evenly over the field as if spreading fertilizer. This should be done just before ploughing, or else the inoculated soil should be harrowed in immediately.

Either of the above methods may be used, as may be most convenient.

Moisture Content of Butters—Season 1903-4.

No. of Sample.	Moisture. %	No. of Sample.	Moisture. %	No. of Sample.	Moisture. %
1	10·94	25	12 24	48	9·69
2	15·84	26	10 99	49	10 82
3	10·54	27	10·67	50	11·74
4	10·20	28	13·13	51	12·30
5	12·88	29	12·19	52	10·63
6	14·36	30	14·51	53	13·45
7	14·04	31	11·28	54	10·11
8	13·75	32	15·48	55	12·74
9	10·64	33	14·53	56	12·20
10	15·00	34	13·05	57	14·58
11	13·18	35	15·94	58	14·59
12	13·52	36	15·38	59	13·76
13	9·22	37	11·69	60	10·02
14	12·91	38	13·85	61	13·98
15	13·61	39	15·33	62	12·20
16	13 89	40	14·46	63	14·22
17	10·92	41	14·93	64	11·70
18	10·07	42	14·78	65	13·53
19	11·13	43	13·04	66	10·20
20	13·81	44	15·38	67	15·45
21	12·48	45	15·11	68	12·10
22	12·92	46	15·41	69	14·30
23	13·10	47	15·21	70	12·94
24	13·56				

Average percentage of moisture, 13·00.

In the above list there are :—

2	between	9 %	and	10 %	...	...	2·85 %	of the number analysed
13	,,	10	,,	11	...	...	18·57	,, ,,
5	,,	11	,,	12	...	...	7·14	,, ,,
12	,,	12	,,	13	...	...	17·14	,, ,,
16	,,	13	,,	14	...	...	22·85	,, ,,
11	,,	14	,,	15	...	...	15·71	,, ,,
11	,,	15	,,	16	...	...	15·71	,, ,,

—*R. Crowe.*

Government Grading of Butter.

The *Sydney Morning Herald's* representative in London has been instituting inquiries there as to the effect of Government grading, and sums up the evidence fairly in the following article :—"In the course of my visits to butter agents and dealers this season I have taken the opportunity to sound them respecting their ideas of Government inspection and grading in New Zealand and Victoria. Of course, I have gone solely on the line, Has this system any effect on this side in getting higher values for butter which has been submitted to such treatment, and in promoting its more ready and

smooth vending? Hudson Brothers inform me that they never buy butter by brand or Government grading; they examine every parcel for themselves. 'We consider, however, that Government grading is good, and that it should be encouraged. Buyers can place some dependence upon goods so treated,' they said. The other gentlemen, whose remarks are above, referred to Government grading as a great cover to the f.o.b. buyer; it protects the buyer, who knows that he can depend upon the soundness of the goods; though the gentleman went on to say that he had known first Government grades New Zealand butter to arrive fishy. On the whole, he thought the New Zealand inspection system a very sound and correct one. Messrs. Trengrouse are of opinion that a great part of New Zealand butter here is sold simply on the recommendation of the first Government grade mark. Buyers write:—"Send us so much of first Government grade week by week." These buyers don't bother about brands except in a secondary way; their dependence is on the Government brand. No doubt they get to know and like certain brands, but without doubt the Government grade is their main reliance. To sum up. In the first place, Government grading and inspection are, of course, highly approved of here by all persons interested in the colonial butter trade; whether it has any important and considerable effect in promoting higher values or not, the general tendency must be for good. The New Zealand methods inspire confidence in buyers here, and lead to an extension of forward buying. Though the first Government grading mark encourages buyers, most of them go by the brands, I think, and would hardly be likely to order 100 boxes of first Government grading butter entirely on the strength of this mark. In the cases mentioned by Messrs. Trengrouse probably their customers referred to have in mind the guarantee, in a sense, which they possess in ordering through such a leading house. But, after all, we must bear in mind that our large buyers go on their own expert judgment. In ordering certain brands they only purchase those special factories on the strength of the reputation for uniformity which the latter have established, these brands having met the requirements of the buyers when they were first sampled. London butter merchants have as acute palates for their goods as have tea-tasters, and they buy particular factories because the output from these meets their wants and maintains its uniform good quality, and they approve of Government grading because they have got to know that it indicates general soundness in all departments of butter manufacture. The Victorian system, "Approved for Export" and "Pastry," is put into the shade by the more thorough New Zealand method. As I said above, I am speaking solely from our point of view, and the Victorian Government mark is considered here too vague, and too much wanting in thoroughness, to have any effect upon buyers.—*Auckland Weekly News.*

THE RAINFALL OF THE YEAR 1903.

By P. Baracchi.

Table I. gives the rainfall registered over the State of Victoria in each month, quarter, and the whole year 1903, and the amounts tabulated for that year are accompanied by corresponding averages based and calculated on all available records of nearly half a century, thus affording easy comparison of the conditions actually experienced in any one locality of the State in the year 1903, with average conditions.

Table II., contains a summary of results for each quarter of the year 1903, arranged into eight subdivisional areas, which represent different characteristics in regard to rainfall distribution.

Table III. gives for each of the above eight regions the percentage above or below average of rainfall actually recorded in each quarter of the year 1903.

An examination of the tables points out the following general facts :—

January.—In the South-western districts, between the South Australian boundary and the Otway Forest, the rainfall conditions did not deviate to any considerable extent from those of normal years. In all other districts south of the Dividing Ranges, from the Moorabool and Barwon Basins to the Snowy River, the January rains were from 30 to 65 per cent. below average, and a general deficiency of from 60 to 70 per cent. occurred over the northern half of the State.

February.—The February rains were again deficient over the eastern half of the State, being below average to the extent of 20 per cent. in South Gippsland, 60 per cent. in all other Gippsland districts and 33 per cent. in the North-eastern districts; but they were above the average everywhere over the Western half of the State, the excess being 77 per cent. in the North-western, and no less than 160 per cent. in the South-western quarters.

March.—The important rains of March were deficient only in the extreme South-eastern region, east of the Tambo River. The average was exceeded by 100 per cent. in South Gippsland, 74 per cent in the country surrounding Port Phillip Bay and the whole of the North-Eastern quarter, 60 per cent in the Western districts, and from 26 to 42 per cent in the remaining areas of the State.

By the end of the summer months we find the rainfall registered since the beginning of the year slightly in excess of the average for the Northern half of the State, more than 50 per cent. above average for the South-western quarter, and 24 per cent. above average in South Gippsland; but all other parts of the South-Eastern quarter show a deficiency of from 30 to 50 per cent.

TABLE I.

SHOWING AVERAGED AMOUNT OF RAINFALL in each of the 26 Basins or Regions, constituting the State of Victoria, for each month and quarter, and for the whole year, together with corresponding monthly, quarterly, and yearly averages for each Basin, deduced from all available records to date.

Name of Basin.	1st Quarter.								2nd Quarter.								3rd Quarter.								4th Quarter.									
	January		Febr'ary		March				April		May		June				July		August		Sept'ber				October		Nov'ber		Dec'ber					
	Amount 1903	Average	Amount 1903	Average	Amount 1903	Average	Total for 1st Quarter	Average for 1st Quarter	Amount 1903	Average	Amount 1903	Average	Amount 1903	Average	Total for 2nd Quarter	Average for 2nd Quarter	Amount 1903	Average	Amount 1903	Average	Amount 1903	Average	Total for 3rd Quarter	Average for 3rd Quarter	Amount 1903	Average	Amount 1903	Average	Amount 1903	Average	Total for 4th Quarter	Average for 4th Quarter	Total Amount for the year 1903	Yearly Average
Glenelg and Wannon Rivers ..	1·69	1·44	1·76	0·62	2·33	1·32	5·78	3·38	3·60	2·39	1·98	2·72	3·50	3·57	9·08	8·68	4·44	3·40	2·74	3·53	3·42	3·04	10·60	9·97	2·30	3·06	2·27	1·72	1·43	1·68	6·00	6·46	31·46	28·49
Fitzroy, Eumerella & Merri Rivers	2·02	1·48	2·79	0·79	2·68	1·51	7·49	3·78	3·99	2·45	2·63	3·09	2·88	4·09	9·50	9·63	4·24	3·76	3·16	3·59	2·57	3·46	9·97	10·81	2·56	3·21	2·15	1·82	1·34	1·78	6·05	6·81	33·01	31·03
Hopkins River & Mt. Emu Creek ..	1·38	1·48	1·65	0·71	2·12	1·52	5·15	3·71	3·93	2·48	2·32	2·48	2·72	3·12	8·97	8·08	4·39	2·64	2·06	2·75	3·17	2·70	9·62	8·09	2·58	3·07	3·20	1·85	2·11	1·85	7·89	6·77	31·63	26·65
Mt. Elephant & Lake Corangamite	0·93	1·43	1·49	0·84	2·37	1·52	4·79	3·79	3·29	2·38	1·89	2·25	2·66	2·74	7·84	7·37	3·81	2·31	2·01	2·58	2·60	2·60	8·42	7·49	2·34	3·01	3·23	1·83	2·16	1·68	7·73	6·52	28·78	25·17
Otway Forest	1·91	1·62	2·18	0·99	3·04	2·14	7·13	4·75	4·77	3·75	3·74	3·87	5·42	4·94	13·93	12·56	4·37	4·82	3·86	4·57	4·07	4·63	12·30	11·02	3·14	4·20	3·23	2·23	2·38	2·76	8·75	9·19	42·11	40·52
Moorabool & Barwon Rivers ..	0·89	1·44	1·37	1·04	2·38	1·67	4·64	4·15	3·56	2·48	1·56	2·42	2·44	2·86	7·56	7·76	2·86	2·50	1·49	2·58	3·31	2·73	7·66	7·81	3·09	2·98	3·94	2·23	1·93	1·87	8·96	7·08	28·82	26·80
Werribee & Saltwater Rivers ..	0·94	1·48	1·26	1·36	2·45	1·95	4·65	4·79	3·01	2·48	1·02	2·42	2·01	2·80	6·04	7·70	2·32	2·29	1·08	2·44	4·40	2·62	7·80	7·35	4·20	2·97	4·69	2·43	2·28	2·02	11·17	7·42	29·66	27·26
Yarra River & Dandenong Creek ..	1·61	1·94	2·42	1·28	4·37	2·31	8·40	5·53	4·87	3·05	3·24	3·09	3·92	3·51	12·03	9·65	2·76	3·44	1·18	3·03	4·25	3·38	8·19	9·85	3·81	3·49	3·93	3·01	3·59	3·33	11·33	9·83	39·95	34·86
Koo-wee-rup Swamp	1·25	1·77	1·84	1·24	4·84	2·15	7·93	5·16	4·72	3·13	2·81	3·31	4·18	4·12	11·71	10·56	2·69	3·69	1·76	3·65	3·56	3·57	8·01	10·91	3·69	3·76	3·63	2·77	3·06	3·12	10·38	9·65	38·03	36·28
South Gippsland	1·44	2·04	1·33	1·67	4·68	2·32	7·45	6·03	4·00	3·48	2·34	3·33	4·18	5·02	10·52	11·83	3·44	3·87	3·32	4·09	4·27	4·28	11·03	12·24	3·43	3·74	2·76	2·92	3·60	3·59	9·79	10·25	38·79	40·35
Latrobe & Thomson Rivers ..	1·39	2·15	1·60	1·55	4·60	2·34	7·59	6·04	3·51	3·21	2·01	2·84	4·42	4·06	9·94	10·11	3·45	3·15	2·17	3·61	3·15	4·14	8·77	10·90	3·82	4·01	2·38	3·46	2·83	3·93	9·03	11·40	35·33	38·45
Macallister & Avon Rivers ..	0·43	2·01	0·40	2·29	1·84	1·65	2·67	5·95	2·01	2·36	0·47	1·90	0·99	2·42	3·47	6·68	1·98	1·60	0·54	2·16	4·33	2·30	6·85	6·06	2·77	3·03	2·45	2·60	1·83	2·71	7·05	8·34	20·04	27·03
Mitchell River	0·53	2·23	0·69	2·52	1·75	1·95	2·88	6·70	2·99	2·71	0·82	2·17	1·17	3·00	4·98	7·88	2·93	2·15	0·60	2·39	4·90	2·77	8·43	7·31	2·74	3·30	3·27	2·75	2·92	2·94	8·93	8·99	25·22	30·88
Tambo & Nicholson Rivers ..	0·85	3·05	0·66	1·44	1·60	1·67	3·11	6·16	3·36	2·67	1·31	1·72	1·18	3·36	5·85	7·75	2·82	3·62	0·55	2·39	4·80	2·20	8·17	8·21	2·74	3·18	2·59	2·14	3·40	2·79	8·73	8·11	25·86	30·23
Snowy River	1·42	3·07	0·61	2·19	1·76	2·50	3·79	7·76	4·37	3·27	4·09	2·29	1·84	4·32	10·30	9·88	3·51	3·57	0·90	2·32	6·09	3·18	10·50	9·07	2·46	3·13	3·36	2·89	3·79	4·35	9·61	10·37	34·20	37·08
Murray River	0·37	1·37	0·67	1·29	2·34	1·84	3·38	4·50	2·55	2·10	0·55	2·46	2·61	3·09	5·71	7·65	2·49	2·22	0·57	2·43	3·46	2·18	6·52	6·83	2·21	2·43	1·49	1·62	2·45	1·91	6·15	5·96	21·76	24·94
Mitta Mitta & Kiewa Rivers ..	0·52	1·72	1·07	2·26	4·48	2·17	6·07	6·15	3·07	2·57	1·10	3·63	4·14	4·99	8·31	11·19	4·65	3·51	1·31	3·45	5·20	3·42	11·16	10·38	3·94	3·40	2·56	2·47	2·32	2·68	8·82	8·55	34·36	36·27
Ovens River	0·53	2·39	1·24	2·01	4·29	2·33	6·06	6·73	3·89	2·85	1·34	4·15	4·95	6·33	10·18	13·33	4·46	4·52	1·60	4·83	4·45	4·31	10·51	13·66	3·39	4·36	2·14	3·09	2·61	3·03	8·14	10·42	34·89	44·14
Goulburn River	0·58	1·47	1·18	1·06	3·54	1·68	5·30	4·21	3·69	2·24	0·97	2·92	3·64	3·42	8·30	8·58	3·23	2·63	1·11	3·06	3·73	2·51	8·07	8·20	2·87	2·91	2·12	2·12	2·27	2·00	7·26	7·03	28·93	28·02
Campaspe River	0·50	1·29	0·88	0·91	2·48	1·83	3·86	4·03	3·31	2·24	0·80	2·87	3·63	3·25	7·74	8·36	3·51	2·58	1·47	2·87	3·91	2·33	8·89	7·78	2·96	2·61	3·54	2·03	1·84	1·91	8·34	6·55	28·83	26·72
Loddon River	0·43	1·11	0·67	0·63	1·67	1·32	2·77	3·06	2·93	1·97	0·93	2·15	2·51	2·42	6·37	6·54	3·48	1·71	1·05	2·07	3·33	1·68	7·86	5·46	2·77	2·07	3·41	1·73	1·75	1·53	7·93	5·33	24·93	20·39
Avon & Richardson Rivers ..	0·10	0·90	0·64	0·41	1·12	0·95	1·86	2·26	2·78	1·71	1·72	1·79	2·19	1·98	6·69	5·48	3·06	1·46	1·29	1·96	3·54	1·52	7·89	4·94	1·83	1·80	2·93	1·46	1·35	1·26	6·11	4·52	22·55	17·20
Avoca River	0·22	0·85	0·56	0·28	1·29	1·19	2·07	2·32	2·58	2·01	1·25	2·05	2·06	2·40	5·89	6·46	3·58	1·72	1·17	1·97	3·44	1·53	8·19	5·22	2·26	2·28	3·18	1·69	1·86	1·43	7·30	5·40	23·45	19·40
Western Wimmera	0·57	1·02	0·93	0·32	1·25	0·88	2·75	2·22	2·71	1·99	1·53	2·06	2·40	2·81	6·64	6·86	2·78	2·59	1·81	2·74	3·21	2.06	7·80	7·39	1·34	2·51	2·43	1·42	0·68	1·51	4·45	5·44	21·64	21·91
Eastern Wimmera	0·51	1·16	0·70	0·36	1·49	1·20	2·70	2·72	3·10	2·13	2·30	2·45	2·45	3·26	7·85	7·84	3·86	2·54	1·90	2·64	4·13	2·22	9·89	7·40	2·16	3·15	2·91	1·65	1·54	1·79	6·61	6·59	27·05	24·55
Mallee Country	0·15	0·82	0·42	0·22	1·29	0·88	1·86	1·92	2·25	1·71	1·25	1·53	1·53	1·95	5·03	5·19	1·96	1·50	1·01	1·73	3.46	1·25	6·43	4.48	1·37	1·99	2·28	1·14	1·04	1·29	4·69	4·42	18·01	16·01
State	0·74	1·48	1·02	0·97	2·38	1·55	4·14	4·00	3·21	2·35	1·64	2·43	2·71	3·21	7·56	7·99	3·17	2·59	1·48	2·70	3·82	2·48	8·47	7·77	2·49	2·83	2·70	1·97	2·00	2·12	7·19	6·92	27·36	26·68

April.—In this month the rains were again plentiful in every part of the State, excepting the North-Western quarter, which suffered a deficiency of 42 per cent. The average was exceeded by 50 per cent. in the South-western quarter, 38 per cent. in the North-eastern quarter, 30 per cent. over the Tambo and Snowy basins, 15 per cent. in South Gippsland, and only very slightly in the remaining Gippsland districts.

May.—May was relatively a dry month for nearly the whole of the State, excepting the Gippsland districts, between the Tambo and Snowy Rivers, where the average was exceeded by 34 per cent. The deficiency was greatest in the Northern areas east of the Campaspe River, and in the Gippsland districts west of the Tambo River, being respectively 70 per cent. and 52 per cent., and ranged from 15 to 30 per cent. in the remaining parts of the State. This deficiency, however, was generally of very little consequence, owing to the copious rains of the two previous months, while the May excess in Eastern Gippsland served to compensate, in part, the persistent deficiency experienced during the first four months of the year.

June.—This month was also dry generally, but in a less degree than the previous month. Again the basins of the Tambo and Snowy Rivers suffered most with a deficiency of 61 per cent., which diminished from 32 to 17 per cent. in the other districts of Gippsland, and from 17 to 6 per cent. in the remaining regions of the State, excepting the Otway Forest, which had a surplus of 10 per cent.

The totals for the second quarter of the year 1903, indicate a close approach to normal rainfall conditions for the whole of the Northern country west of the Campaspe River; a slight excess of from 4 to 11 per cent of the average for the Western districts and the counties around Port Phillip Bay, and a deficiency of from 8 to 25 per cent. of the average for the Eastern half of the State, the maximum shortage occurring in Central Gippsland.

July.—Plentiful rains, 62 per cent. above the average, fell in this month over the North-western quarter of the State, including most of the Mallee lands; also, 20 per cent. above average over the North-eastern quarter, 40 per cent. above average over the extreme Western districts, and 21 per cent. above average over Central Gippsland; but for all other remaining districts a slight deficiency occurred of from 9 to 12 per cent. of the average.

August.—This month was exceptionally dry throughout the State, but more so in the Eastern half, where the rainfall was from 60 to 70 per cent. below average. The deficiency for the North-western quarter was 37 per cent., and for the remaining districts 20 per cent. below average.

September.—The Cape Otway Forest was the only region where the September rains were below average. In the Western districts and in South Gippsland normal rainfall conditions prevailed. The excess was 26 per cent. of the average for the counties around

Port Phillip Bay, 34 per cent. over Central Gippsland, 41 per cent. over the North-eastern quarter, 102 per cent. over the basins of the Tambo and Snowy Rivers, and not less than 105 per cent. above average over the whole of the North-western quarter, including again most of the Mallee lands.

The results for the third quarter are most satisfactory for the Northern country west of the Campaspe River, showing an excess of about 40 per cent. of the average rainfall. The Western districts and Eastern Gippsland shows also a slight excess of from 3 to 6 per cent. of the average; but for the Cape Otway Forest, counties around Port Phillip Bay, South Gippsland, and the North-eastern districts, the totals are from 4 to 12 per cent. below average.

October.—In this month the average rainfall was exceeded by 12 per cent. in the districts around Port Phillip Bay, and nearly equalled in the North-eastern quarter of the State; but a deficiency was experienced in all other parts amounting to 23 per cent. of the average for the Western districts, and from 8 to 18 per cent. of the average for the remaining areas.

November.—November was a wet month, and its rainfall generally exceeded the average, excepting that in South Gippsland and Central Gippsland it was 6 per cent. below average.

The Western half of the State was again favoured with plentiful rains, 90 per cent. above average being recorded in the North-west and Mallee country, and 50 per cent. in the South-western quarter. Eastern Gippsland received 18 per cent., and the North-eastern quarter 5 per cent., above average.

December.—The December rain did not differ very considerably from normal conditions. It was below average by 14 per cent. in the Cape Otway Forest, 21 per cent. in Central Gippsland, 7 per cent. in the North-western quarter; and above average by 15 per cent. in the Western districts, and 5 per cent in the country around Port Phillip Bay, the average being just reached in the remaining parts.

The Year as a Whole.—The rainfall records for the year 1903, show the following prominent characteristics :—

The Western half of the State received from 4 to 16 per cent. more, and the Eastern half from 4 to 15 per cent. less than the average yearly rainfall for these parts respectively.

There were long periods of relative dryness in the Eastern districts, more especially during the colder months of the year, which were somewhat severely felt in some parts, chiefly in Gippsland; but the autumn and spring rains, which are always the most necessary and beneficial, were sufficient to ensure the success of the seasons, even in the least favoured localities.

Amongst the year's accounts of floods we find recorded, the April flood at Maryborough, the July floods in various parts

especially on the Avoca and the Wimmera basins, and some local floods in October caused by storm rains.

The heavy rains towards the end of October caused some damage to crops, especially in the Bendigo district. Thus it appears that the record of disastrous occurrences due to excess or deficiency of rainfall in 1903, compares very favorably with almost any previous year. The country was green everywhere throughout the year, and the distribution of rainfall was more generally favourable to agricultural interests than it has been in the previous 8 years.

TABLE II.

SUMMARY OF RAINFALL for the eight principal sub-divisions of the State for each quarter of the year.

Period of the Year.	South-Western Quarter				Central Southern Districts around Port Phillip Bay		South-Eastern Quarter				Northern Districts				Mallee	
	Western Districts		Otway Forest				South Gippsland		Gippsland		East of the Campaspe River		West of the Campaspe River			
	Year 1903	Average	Year 1903	Average	Year 1903	Average	Year 1903	Average	Year 1903	Average	Year 1903	Average	Year 1903	Average	Year 1903	Average
First Quarter ..	5·80	3 66	7 13	4·75	6·40	4·91	7 45	6·03	4 01	6 52	4 93	5 13	2 43	2 51	1 86	1 92
Second Quarter ..	8 85	8 44	13·93	12 56	9 33	8 92	10.52	11 83	6·91	8 46	8 05	9 82	6 69	6 64	5 03	5 19
Third Quarter ..	9 65	9·09	12 30	14 02	7 91	8 98	11 03	12 24	8 54	8 31	9 03	9 37	8 32	6 08	6 43	4·48
Last Quarter ..	6 92	6 64	8 75	9·19	10·46	8 49	9 79	10·25	8 67	9 44	7 74	7 70	6 48	5·46	4 69	4·42
Whole Year	31·22	27·83	42·11	40·52	34 10	31 30	38·79	40·35	28 13	32 73	29·75	32 02	23 92	20 69	18 01	16·01

TABLE III.

PERCENTAGE ABOVE OR BELOW AVERAGE for the eight principal sub-divisions of the State, and for each quarter of the year.

+ Above average.
− Below average.

Period of the Year.	South-Western Quarter		Central Southern Districts around Port Phillip Bay	South-Eastern Quarter		Northern Districts		Mallee
	Western Districts	Otway Forest		South Gippsland	Gippsland	East of the Campaspe River	West of the Campaspe River	
	Year 1903	Year 1903	Year 1903	Year 1903	Year 19·3	Year 1903	Year 1903	Year 1903
First Quarter ..	+ 58	+ 50	+ 30	+ 24	− 39	− 4	− 3	− 3
Second Quarter ..	+ 5	+ 11	+ 5	− 11	− 18	− 18	+ 1	− 3
Third Quarter ..	+ 6	− 12	− 12	− 10	+ 3	− 4	+ 37	+ 43
Last Quarter ..	+ 4	− 5	+ 23	− 4	− 8	+ 5	+ 19	+ · 6
Whole Year ..	+ 12	+ 4	+ 9	− 4	− 14	− 7	+ 16	+ 12

RAINFALL IN VICTORIA.

MONTHS OF FEBRUARY AND MARCH, 1904.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in Feb., 1904.	Average rainfall for each Area for the month of Feb. based on all previous years of record.	Maximum fall recorded within each Area during Feb., 1904.	Actual Average rainfall recorded in each Area in March, 1904.	Average rainfall for each Area for the month of March, based on all previous years of record.	Maximum fall recorded within each Area during March, 1904.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	1·30	0·20	2·42 at Mildura	0·28	0·86	0·45 at Hopetoun
B	1·57	0.27	2·10 ,, Warracknab'l	0·27	0.88	0·51 ,, Serviceton
C	1·93	0·59	2·64 ,, Wickliffe	0.86	1·33	1·21 ,, Panmure
D	2 10	0.85	3·40 ,, Cobden	1·05	1·65	1·26 ,, Cape Patton
E	0·46	0·51	0·98 ,, Charlton	0·24	1·16	0·38 ,, Wycheproof
F	0·87	1·07	1 96 ,, Chiltern	0·35	1·57	0·95 ,, Benalla
F^1	0·91	0 94	1·73 ,, Yea	0.33	1·72	0·72 ,, Yea
F_2	1·89	2·06	2·52 ,, Wodonga	0·78	2·64	1·08 ,, Tallangatta
G	1·40	0·64	2·67 ,, Allendale	0·48	1·48	0·62 ,, Maldon
H	2·45	1·14	2·70 ,, Kilmore	0·56	1·93	0·59 ,, Daylesford
I	3·89	0 99	6·24 ,, Melbourne	0·77	1·69	1 23 ,, Ballan
I^1	4·37	1·31	5·22 ,, Dandenong	0·76	2·22	0·83 ,, Dandenong
K	2·83	1·89	7·17 ,, Warburton	0.89	2·51	1·65 ,, Warburton
L	3·01	1 84	5 07 ,, Bruthen	0·57	2·07	0.80 ,, Bairnsdale
M	—	3·32	3·93 ,, Gabo	—	2·74	0·71 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F^1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F^2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I^1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

The Season's Crops.—Preliminary Return.

AREA AND PRODUCE, 1903–4.

Name of Crop.	Area Under Crop.	Produce.	Average per Acre.
	Acres.	Bushels.	Bushels.
Wheat	1,943,010	28,356,082	14·59
Oats	430,292	13,375,148	31·08
Barley—Malting	33,202	869,551	26·19
,, Other	13,853	373,753	26·98
Maize	11,981	*778,765	*65·00
Rye	1,997	29,195	14·62
Peas and Beans	8,782	228,818	26·06
		Tons.	Tons.
Potatoes—Dug	6,759	21,055	3·11
,, Not dug	38,536	—	—
Mangels	1,513	20,962	13·85
Beet, Carrots, Parsnips and Turnips ..	765	6,448	8·43
Onions	4,080	24,925	6·11
Hay—Wheaten	197,926	323,059	1·63
,, Oaten	514,274	874,456	1·70
,, Other	9,615	13,801	1·44
		Cwt.	Cwt.
Grass—Cut for seed	2,749	6,367	2·32
Green Fodder of all kinds	33,208	—	—
Vines	25,728	—	—
Orchards and Gardens	60,654	—	—
Other Tillage	3,209	—	—
Total Area under Crop	3,342,133	—	—
Land in Fallow	632,274	—	—
Total Cultivation	3,974,407	—	—

PRINCIPAL CROPS.—RETURN FOR SIX YEARS.

AREA UNDER CROP.

Year.	Wheat.	Oats.	Barley.		Potatoes	Hay.	Total.
			Malting.	Other.			
	Acres.	Acres.	Acres	Acres	Acres.	Acres.	Acres.
1898-1899	2,154,163	266,159	33,584	14,275	41,252	565,345	3,074,778
1899-1900	2,165,693	271,280	65,970	13,603	55,469	450,189	3,022,204
1900-1901	2,017,321	362,689	49,723	9,130	38,477	502,105	2,979,445
1901-1902	1,754,417	329,150	25,480	6,943	40 058	659,239	2,815,287
1902-1903	1,994,271	433,489	26,436	11,280	49 706	580,884	3,096,066
1903-1904	1,943,010	430,292	33,202	13,853	45,295	721,815	3,187,467

GROSS PRODUCE OF CROP.

Year.	Wheat.	Oats.	Barley.		Potatoes.	Hay.
			Malting.	Other		
	Bushels.	Bushels.	Bushels.	Bushels.	Tons.	Tons.
1898-1899	19,581,304	5,523,419	776,785	335,782	161,142	723,299
1899-1900	15,237,948	6,116,046	1,197,948	268,140	173,381	596,193
1900-1901	17,847,321	9,582,332	1,003,477	212,001	123,126	677,757
1901-1902	12,127,382	6,724,900	527,564	166,287	125,474	884,369
1902-1903	2,569,364	4,402,982	394,877	166,267	168,759	601,272
1903-1904	28,356,082	13,375,148	869,551	373,753	†	1,211,316

AVERAGE YIELD PER ACRE.

Year	Wheat.	Oats.	Barley.		Potatoes.	Hay.
			Malting.	Other.		
	Bushels.	Bushels.	Bushels.	Bushels.	Tons.	Tons.
1898-1899	9·09	20·75	23 13	23 52	3 91	1·28
1899-1900	7·04	22·55	18·16	19·71	3·13	1·32
1900-1901	8·85	26 42	20·18	23·22	3·20	1·35
1901-1902	6·91	20·43	20·71	23·95	3 13	1·34
1902-1903	1·29	10 16	14·94	14·74	3 40	1·04
1903-1904	14·59	31·08	26 19	26·98	†	1·68

NOTE.—Owing to the lateness of the season in some districts, the collectors were compelled to obtain the best reliable estimate of the yield where threshing had not been completed. In a few of the districts the returns are still incomplete.

* Estimated.

† Returns incomplete. The quantity derived from 6,759 acres which had been dug was 21,055 tons, or 3·11 tons per acre, as against 7,787 acres and 25,463 tons, or 3·27 tons per acre, in the preceding year.

W. McLEAN,
GOVERNMENT STATIST.

Perishable and Frozen Produce.

EXPORTS FOR FEBRUARY AND MARCH, 1904 AND 1903.

Description of Produce.		1904. February.	1904. March.	1903. February.	1903. March.
Butter..	lbs.	2,852,592	3,999,136	927,001	732,368
Cheese	lbs.	66,720	98,400	55,928	62,310
Milk and Cream	cases	1,372	966	1,748	882
Ham and Bacon	lbs.	95,280	135,840	62,348	80,892
Poultry	head	1,862	1,050	10,928	19,395
Eggs	dozen	4,484	2,034	8,207	9,720
Mutton and Lamb ..	carcases	6,189	2,093	49,086	13,940
Pork	,,	60	8	—	—
Veal	,,	503	153	672	636
Beef	quarters	396	276	692	600
Rabbits and Hares ..	pairs	182,720	198,960	399,084	328,404
Fruit	cases	9,438	45,294	18,127	33,715
Fruit Pulp	,,	15,862	4,084	2,462	1,040

R. CROWE.

ARRIVALS IN MELBOURNE OF BUTTER and Butter ex Cream in Tons net, by Rail and Steamer from the different districts of the State for the last 13 months, as compared with the previous corresponding months.

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
March ..	1371	977½	112	92	27	25	740½	650	491½	210½
April ..	910½	597½	140	60	14½	16	443	359	313	162½
May* ..	794	670	137	95	14	13	354	421	289	141
June ..	595½	473	118	40	13½	22	213	247	251	164
July ..	561½	435½	106	54½	16½	17	179	190	260	174
August ..	641	468	163	99	33	24	122	122	323	223
September ..	1288	1042	323½	216	87½	63	317	267	560	496
October	2122	1807	439	360	174	92	697	567	812	788
November ..	2750	2049	622	430	201	94	943	787	984	738
December ..	2756	1995	528	358	194	83	1026	860	1008	694
	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.
January	2220	1985	403	362	150	66	917	870½	750	686½
February ..	2047	1383½	407	90½	170	51½	844	814	626	427½
March	2033	1371	316	112	156	27	938	740¾	623	491½

*Including 350 tons which it is estimated came by road during the strike.

R. CROWE.

DELIVERIES FROM THE GOVERNMENT COOL STORES FOR FEBRUARY AND MARCH, 1904 AND 1903.

Description of Produce.		1904. February.	1904. March.	1903. February.	1903. March.
Butter..	lbs.	2,040,360	2,048,536	293,888	206,752
Milk and Cream	cases	510	557	1,033	797
Poultry	head	148	525	7,309	3,534
Eggs	dozen	1,432	4,055	6,659	8,680
Rabbits and Hares ..	pairs	178,303	145,260	262,324	191,153
Mutton and Lamb ..	carcases	783	621	22,248	8,342
Beef	quarters	12	40	—	—
Veal	carcases	246	105	227	260
Pork	,,	38	—	—	—
Fruit	cases	2,555	1,980	4,100	8,794
Fruit Pulp	,,	717	313	—	378
Sundries	lbs.	14,066	7,577	5,412	766

R. CROWE.

Fruit and Plants.

EXPORTS to Australian States and New Zealand, Inspected during February and March, 1904.

Fruit.	Cases or Packages Inspected.		Certificates Given.	
	February.	March.	February.	March.
Apples	2592	4347	145	147
Apricots	48	—	—	18
Bananas	1199	1198	231	245
Cucumbers	27	32	7	21
Figs	6	8	3	7
Grapes	1388	1647	241	299
Lemons	139	88	51	49
Melons	2	32	1	29
Mixed Fruits	20	2	7	2
Nectarines	95	17	40	15
Oranges	66	79	28	55
Passion Fruit	32	39	18	25
Peaches	973	964	263	276
Pears	9528	5759	202	237
Pineapples	203	138	88	103
Plums	1192	570	98	49
Quinces	—	140	—	40
Tomatoes	110	94	33	29
Plants	—	7	—	6
Bulbs	—	2	—	2
Totals	17,620	15,163	1,456	1,654

J. G. TURNER,
For C. French.

EXPORTS beyond the Australian Commonwealth and New Zealand, during Season 1904, (to end of March only).

Destination.	Apples. Cases.	Pears. Cases	Grapes. Cases.	Totals.
United Kingdom	29478	1631	15	31124
India	1033	—	—	1033
South Africa	240	—	—	240
Germany	3364	15	—	3379
Belguim	200	—	—	200
Italy	500	—	—	500
Java	467	19	—	486
Malay Peninsula	226	—	—	226
Mauritius	200	—	—	200
Totals	35,708	1,665	15	37,388

J. G. TURNER,
For C. French.

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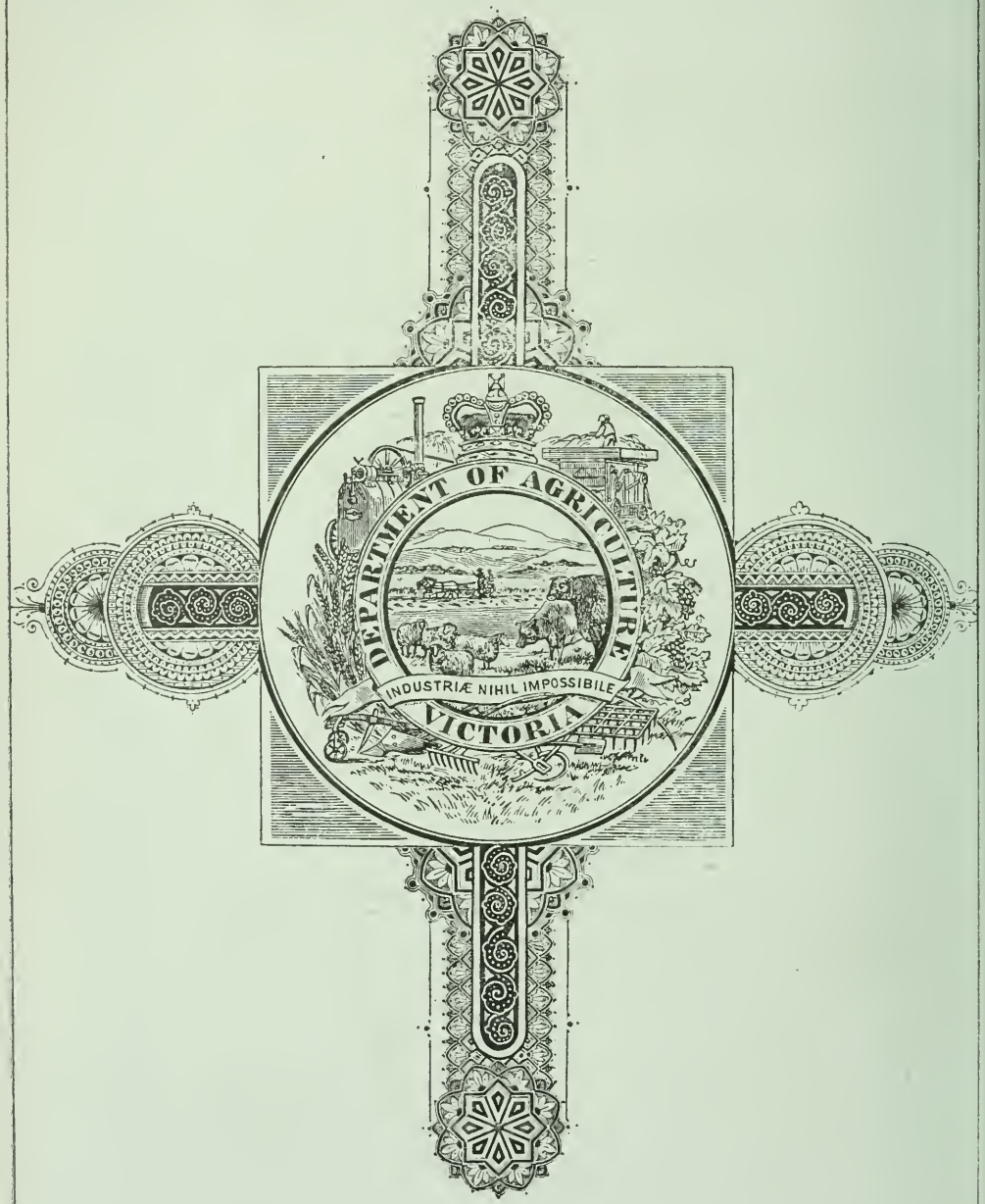
DEPARTMENT OF AGRICULTURE
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July

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OF

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1904

The Journal is now issued bi-monthly, that is to say, every alternate month. The Minister of Agriculture has directed that a charge of 2s. 6d. per annum shall be made, and to persons outside the State the charge will be 3s. 6d. Those who desire to receive future issues must, therefore, remit that amount without delay to the Secretary for Agriculture.

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Melbourne.

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Herewith I beg to forward the sum of two shillings and sixpence (2s. 6d.), being subscription to the Journal of Department of Agriculture for the year ending 31st August, 1905.

Signed .....

Address .....

.....

Date ...

AGRICULTURAL JOURNAL OF VICTORIA.

JULY, 1904.

FIELD EXPERIMENTS IN MANURING, 1903-4.

By F. J. Howell, Ph.D.

1. Hay Manuring Experiments.

Continued from page 592.

Superphosphate Compared with Thomas Phosphate.

The tests of the preceding year appeared to indicate that Thomas phosphate, used in the same quantity as superphosphate, would more closely approach the latter in effective power, under the more favorable moisture conditions of the South than under those obtaining in the North. Assuming that a high grade article of Thomas phosphate will always be obtained on the market, there appears further evidence in the present year's returns to strengthen this opinion. But this fertilizer unfortunately has shown a tendency to vary in composition, and in the article at our disposal last year the falling off in the percentage of citrate soluble was sufficiently marked to show an effect, in the relatively smaller yields produced, compared with superphosphate. The differences in position of the two manures have also been somewhat widened by slightly higher percentages of phosphoric acid in last year's superphosphate than in the preceding year's sample. Owing to the improvement in the character of some of the recent imported brands and the excellence of the local manufacture, the bulk of the superphosphates now offering is of a splendid standard, and little more can either be wished for or expected in this direction. As long as Thomas phosphate retains a composition similar to the one used in the experiments, there is every warranty for stating that the use of the superphosphates will result in larger yields to an extent justifying an undoubted claim to first consideration. With an improvement in composition on the part of Thomas phosphate, equalling the figures of the earlier analyses carried out in this laboratory, the present differences so largely in favor of superphosphate will naturally be considerably reduced. The composition of the two fertilizers used in the experiments during the two years is given below. Earlier analyses than these revealed a quality of Thomas phosphate superior to the best here shown, reaching as high as 20 per cent. of phosphoric acid.

Analysis of Manures Used.

Experiments 1902-3.

SUPERPHOSPHATE.

Water soluble phosphoric acid	17·63
Citrate soluble phosphoric acid	1·55
Total phosphoric acid	19·18

THOMAS PHOSPHATE.

Citrate soluble phosphoric acid	14·79
Insoluble phosphoric acid	2·37
Total phosphoric acid	17·16

Experiments 1903-4.

SUPERPHOSPHATE.

Water soluble phosphoric acid	19·19
Citrate soluble phosphoric acid	1·62
Total phosphoric acid	20·81

THOMAS PHOSPHATE.

Citrate soluble phosphoric acid	11·83
Insoluble phosphoric acid	5·41
Total phosphoric acid	17·24

It will be observed that the superphosphate used last year was of a slightly higher standard than that used in the preceding, while with Thomas phosphate, owing to the larger percentage of insoluble, the position was reversed, both differences contributing to the larger relative superiority of the superphosphate in the returns of the present than earlier results. Field results, it will be seen from the following figures, have largely supported the figures of the analysis.

Yields of Hay in Tons on Fields Manured with Superphosphate and Thomas Phosphate.

	2 cwt. Superphosphate per acre	2 cwt. Thomas Phosphate per acre.	In favor of Superphosphate
Average yield of 30 fields 1902-3	2·32	2·18	·14
Increase due to manures	·66	·52	
Average yield of 27 fields 1903-4	2·04	1·83	·21
Increase due to manures	·68	·47	

The results of both years show differences in favor of the use of superphosphate sufficiently large to merit consideration. This is especially the case in the second year's returns.

The Average Results Applicable to Soils Generally.

A study of the individual returns of Table B will reveal the fact that the conclusions to be drawn from the figures of the average of

all the fields, as to the stronger operative effect of superphosphate, are supported, with very few exceptions, by the individual yields throughout—the yields in 22 cases out of 27 being larger on the superphosphate plot than on the Thomas phosphate. A comparison of the two columns of figures will indicate the differences in favor of superphosphate in each case.

	Yields of Hay in Tons Obtained from	
	2 cwt. Superphosphate per acre.	2 cwt. Thomas Phosphate per acre.
Lewis	2·22	2·04
Dalton	2·40	1·65
O'Shannassey	·44	·42
Johnston	3·51	3·31
Rooney Bros.	2 57	2·42
Rae	2·22	1·96
Allwood	1·45	1·20
Stanhope	2·18	1·87
Trigg	2·55	2·03
Taylor	4·46	3 00
Drake	2·10	1·82
Wheildon	1·17	·99
Kett	1·78	1·32
Baird	1·78	1·73
Williams	2·57	2·39
McSkimming	3·64	3·50
Stafford	1·07	·87
Casement	2·12	1·62
Forsyth	1·00	·82
Hill	2·27	1·67
Jenkins	3·19	2·27
McGrath	1·58	1·50

These figures alone are sufficiently regular and striking to warrant the expression of an opinion in favor of the superiority of superphosphate on the great bulk of Southern soils. The fact, however, gains further substantial confirmatory support from the comparison of results obtained where the two fertilizers, in equal quantities, have been applied with other manures. The following figures giving the average returns of 27 fields will illustrate this :—

Comparative Yields of Hay Produced by Superphosphate and Thomas Phosphate Alone and in Combination.

	2 cwt. Alone.	With 2-3rd cwt. Potash Chloride.	With 1 cwt. Nitrate of Soda.	With 1 cwt. Nitrate of Soda and 2-3rd cwt. Potash Chloride.
	Tons.	Tons	Tons.	Tons.
Superphosphate	2·04	2·08	2·37	2·30
Thomas phosphate	1·83	1·88	2·13	2 20
In favor of superphosphate ...	·21	·20	·24	·10

It will be observed that the differences in favor of superphosphate are singularly regular—in fact almost identical in the first three comparisons—and a larger increased yield of 1-5th of a ton to the acre might apparently be accepted as the minimum obtained from 2 cwt. over a like quantity of Thomas phosphate.

BONEDUST COMPARED WITH SUPERPHOSPHATE AND THOMAS PHOSPHATE.

In the returns of the preceding year (1902-3) the yields of hay obtained from equal quantities of the three phosphatic manures, taking an average of the 30 fields, were as follows:—

2 cwt. Superphosphate.	2 cwt. Thomas Phosphate.	2 cwt. Bonedust.	Average of all Unmanured Plots.
Tons.	Tons.	Tons.	Tons.
2·32	2·18	2·14	1·66

In this case the average yield of the bonedust plots was below that of both superphosphate and Thomas phosphate. The returns of last year, however, indicate a marked improvement in the relative position held by bonedust. The more effective action is undoubtedly due, principally, to the copious rains of last year, but partly also to an improvement in the mechanical condition of last year's manure sample. In the preceding year it will be remembered that extremely dry conditions prevailed. The fairly high nitrogen content of our bonedusts, an almost universal response of Southern soils to this ingredient, and a growing improvement in the mechanical condition of the manure, evidenced by a larger percentage of fine material than formerly, will help to lift this manure, should it show no unfavorable variation in quality, into a far higher relative position in the South, as regards its operative effect with respect to superphosphate, than it holds in the North. It is doubtful, however, in a season of ordinary rainfall whether, even with the improvements in the mechanical conditions referred to, a high grade sample, used in equal quantity, will show an operative effect quite equal to that of the high grade superphosphate. In a season of abundant rainfall the returns of last year would appear to indicate that the returns of the two would show no great differences.

YIELDS OF HAY IN TONS SECURED ON PLOTS MANURED WITH 2 CWT. OF SUPERPHOSPHATE, THOMAS PHOSPHATE, AND BONEDUST IN THE SEASON 1903-4.

Superphosphate.	Thomas Phosphate.	Bonedust.
2·04	1·83	1·96

The analysis of the bonedust used in the experiments showed the following composition as already stated in an earlier part of this paper:—

Phosphoric acid	20·35 %
Nitrogen	3·87 %
MECHANICAL ANALYSIS.	
Coarse bone	62·53 %
Fine bone	37·47 %

Fine, is the portion which passes through a sieve of 50 linear meshes to the inch, and coarse, the portion retained on the 50 inch mesh sieve. It is advisable for a quick operative manurial effect to have a much larger percentage of fine material than even shown in this sample, and, in purchasing, the farmer should observe this point as well as noting the contents of phosphoric acid and nitrogen, which, in a good sample, should approximate to or might exceed the figures given above.

The Cost of the Three Manures.

The cost of the three manures is another point requiring consideration by the farmer, for although one of the manures might give a lower return in the field than a corresponding quantity of another, it might be still advisable to purchase this manure giving the lower result on account of its lower price. For instance, taking the average figures just dealt with, 2 cwt of bonedust of the composition of the one above would give ·13 tons more hay than an equal quantity of Thomas phosphate, or 1 ton of bonedust would give a larger increased yield of hay by 1·3 tons than 1 ton of Thomas phosphate. But Thomas phosphate is quoted at £4 10s. a ton, while a bonedust of the above composition would probably cost £5 10s. or more per ton. If the value of the increased yield produced by one manure did not equal or exceed the extra cost of that manure, it would clearly be of no benefit to give that manure the preference. In the present case it does, although, with the former higher standard of quality possessed by Thomas phosphate and in seasons not so exceptionally favorable to the action of bonedust as the last appeared to be, it is probable that with present prices obtaining the difference would not be very considerable. For the relative positions in the experiments (Table B) held by the three manures based on money profits, the following figures might interest the farmer :—

Increased Yield of Hay Produced by	2 cwt. Superphosphate per acre.	2 cwt. Thomas Phosphate per acre.	2 cwt Bonedust per acre.
	Tons. ·65	Tons. ·45	Tons. ·58
Cost of manure used	9/6	9/-	11/-
Value of increased yield at 50/- per ton ...	32/6	22/6	29/-
Profit per acre	23/-	13/6	18/-

These figures bring into very striking prominence the superiority of the superphosphate as a phosphatic manure. The farmer, however, will clearly understand that it is only from an article showing a similar chemical composition to the one used in these experiments that he can expect corresponding results. There are different qualities or grades of artificial fertilizers as there are different qualities of tea, sugar and other articles of commerce. The farmer should not merely go upon the name of a manure, but his practice

should be to demand, before purchase, a copy of the analysis of the article he intends buying. The manures used in the present experiments are not picked manures, but represent the general character of the great bulk offering. An article may be offered which at times slightly exceeds or fails to come up to these standards, but anything materially falling away from these standards can be regarded as of a lower money value and incapable of producing results at all equivalent to those which have just been given.

The Limits of the Profitable Applications of Phosphatic Manures.

The average yield of the 50 fields on Plots 1, 3 and 4, will indicate the probable limits of the profitable applications of superphosphate in the growing of hay crops on Southern soils generally. These quantities refer to applications with the drill; where applied broadcast, heavier dressings would probably be required to produce corresponding results. The average yields of 50 fields resulting from varying quantities of superphosphate with the gains in each case were as follows:—

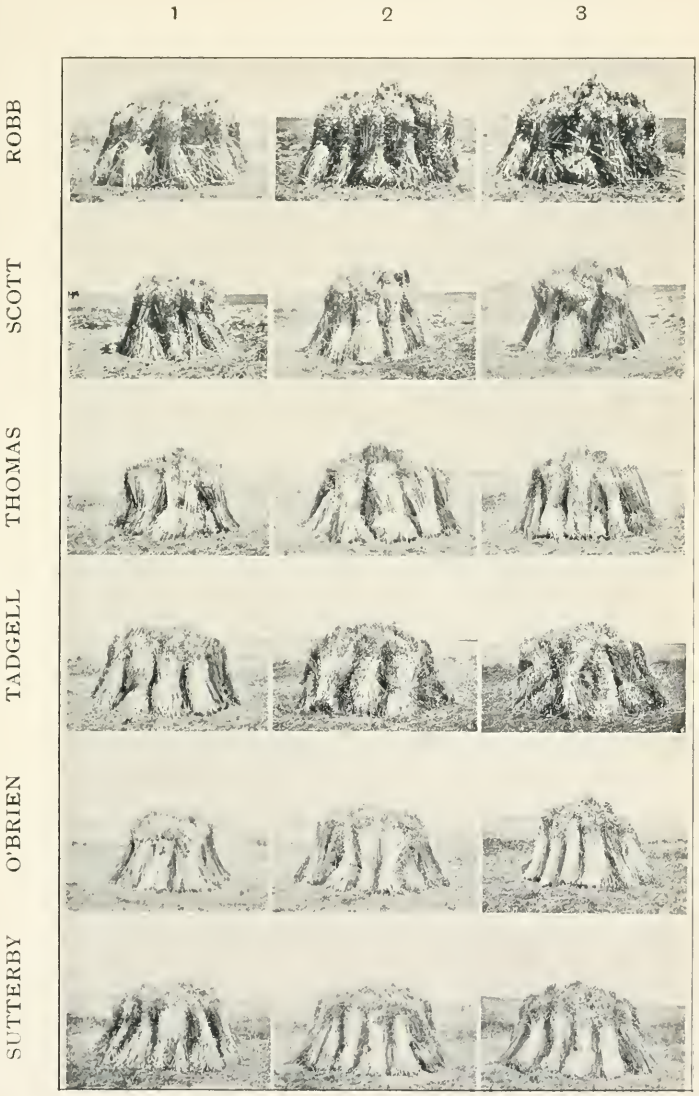
Yields of Hay.

	Unmanured per acre.	1 cwt. Superphosphate per acre.	2 cwt. Superphosphate per acre.	3 cwt. Superphosphate per acre.
	Tons.	Tons.	Tons.	Tons.
Average yield of 30 fields, 1902-3...	1·66	2·18	2·32	2·44
Gain due to manures		·52	·66	·78
Average yield of 50 fields, 1903-4...	1·46	2·03	2·26	2·28
Gain due to manures		·57	·80	·82

It would appear from these figures that anything above 2 cwt. to the acre could not be expected to produce material increases in yield. A study of the individual returns of Table A indicates that the average figures may in this respect be accepted as a fair guide, generally speaking, for in only 30 out of the 50 fields of last year are the returns from the 2 cwt. exceeded by those from the 3 cwt., and in the majority of cases where this does take place, the difference is not a considerable one. As, however, field results show a response of Southern soils to nitrogenous fertilizers also, it is probable that perhaps even less than 2 cwt. of superphosphate in combination with a nitrogenous manure might be found advisable on many soils of the South.

The Effect of Nitrogen.

The results under review give striking evidence of the effects produced by nitrogenous manures on hay crops on Southern soils. The present results in this respect confirm fully those obtained in the preceding year, although the increased yields, taking the average of the 50 fields for the season 1903-4, are not quite so large as they were for the average of 30 fields in the preceding season. The returns for the two seasons were as follows:—



EFFECT OF ADDING NITROGEN TO PHOSPHORIC ACID ON $\frac{1}{20}$TH ACRE PLOTS

(1) 1 cwt. superphosphate (2) 1 cwt. superphosphate and ½ cwt. sulphate of ammonia; (3) 1 cwt. superphosphate and ½ cwt. nitrate of soda.

	Increased Yields Produced by		
	2 cwt. Superphosphate.	2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia.	2 cwt Superphosphate, 1 cwt Nitrate of Soda.
	Tons.	Tons.	Tons.
1902-3 Average of 30 fields	·66	1·20	—
1903-4 Average of 50 fields (Table A) ...	·80	1·20	1·09

In the first season's returns, the addition of sulphate of ammonia to 2 cwt. of superphosphate appears to have resulted in a further increase in the crop by more than half a ton to the acre, while in the second season the increase, produced by the further addition of nitrogen, amounts to 2-5ths of a ton only. As shown by the figures, there was an additional check on the effect of the nitrogenous fertilizers last season by an application also of an equal quantity of nitrate of soda in place of the sulphate of ammonia. The increased yield from the nitrate of soda is less by practically 1-10th of a ton than that from the sulphate of ammonia, but the effects of the nitrogenous application, in both cases, are sufficiently large to direct attention to the requirements of our soils in this ingredient. Reference to the figures of Table A will show that in 47 out of the 50 cases the yields are larger where a phosphatic and nitrogenous combination has been used than where a phosphatic only has been applied. The following figures show the comparative yields in 44 cases where the sulphate of ammonia has been used in the combination :—

Table showing Larger Yields due to Nitrogen Manuring Taken from Table A.

	2 Cwt. Ordinary Superphosphate.	2 Cwt. Ordinary Superphosphate, 1 Cwt. Sulphate of Ammonia.
	Tons.	Tons.
Madden Bros, Yambuk ...	2·90	2·95
P. Madden, Yambuk ...	1·75	2·24
R. Lewis, Yambuk	2·22	2 91
J. Dalton, Yambuk	2·40	2·56
D. O'Shannassey, Yambuk ...	·44	·57
D. H. Johnson, Wickliffe ...	3·51	4·17
Rooney Bros., Warrnambool ...	2·57	3·05
Jas. Rae, Naringal	2·22	2·99
J. Killeen, Mepunga	1·36	1·89
H. T. Allwood, Mepunga ...	1·45	1·70
J. Stanhope, Mepunga ...	2·18	2·64
J. Trigg, Senr., Mepunga ...	2·55	2·73
D. Rae, Cudgee	2·34	3·35
T. Drake, Allansford... ...	2·10	2·62
C. J. Taylor, Allansford ...	·82	2·00
W. Wheildon, Longwarry ...	1·17	1·75
D. Kett, Longwarry	1·78	2·03
W. Baird, Longwarry ...	1·67	2·52

TABLE SHOWING LARGER YIELDS, ETC.—*Continued.*

	2 cwt. Ordinary Superphosphate.	2 cwt. Ordinary Superphosphate, 1 cwt. Sulphate of Ammonia.
	Tons.	Tons.
T. Maisey. Longwarry ...	·90	1·58
A. Williams, Garfield ...	2 57	2·90
W. McSkimming, Bunyip ...	3·64	4·30
T. Strafford, Bunyip... ..	1·07	1·40
W. Forsyth, Bunyip... ...	1·00	1·74
E. S. Hill, Bunyip South ...	2·27	2·50
J. Jenkins, Koo-wee-rup ...	3·19	3 36
P. McGrath, Loch	1·58	2·23
J. Collins, Irrewarra	3·29	3·48
Jno. Wylie, Turkeith ...	2·65	3·48
Jno. Wylie, Turkeith ...	3·25	3·47
W. T. Fish, Yeo	3·57	4 20
W. Parker, Yeo	2·39	3·34
W. Muhlebach, Batesford ...	2·62	2·67
W. Scott, Connewarre ..	1·66	2·00
J. Larkin, Moolap	1·37	2·01
R. H. Sutterby, Moolap ...	2·09	2·38
R. Blyth, Barwon Heads ...	2·12	2·17
J. O'Brien, Cowies Creek ..	1·65	3·24
J. Jinks, Curlewis	2·04	2·86
Paech Bros., Germanton ...	1·18	1·96
T. McCann, Ceres	2·29	2·60
J. Robb, Geelong West ...	3·61	3·62
J. McCurdy, Geelong ...	2·60	2·72
T. A. Grant, Toolern ...	4·75	5·00
Jas. Cuthbert, Burwood ...	2·17	2·18

The figures disclose, in cases, a very marked action on the part of sulphate of ammonia, and there seems every reason to believe that the yields of hay crops, on the generality of soils in the South, may be increased by the application of a suitable nitrogenous fertilizer to an extent exceeding the figures of the average. An attempt has been made to illustrate by photographs the heavier yields of a few of the nitrogen plots. In these cases, however, the quantity of nitrogen applied was only one-half of that given in Plots 12 and 15 of Table A.

THE PREFERABLE FORM OF A NITROGENOUS FERTILIZER.

Tests were carried out on the 50 fields, as already stated, to determine the comparative effect of equal quantities of sulphate of ammonia and nitrate of soda in combination with superphosphate. The sulphate of ammonia was applied with the drill at the time of sowing the grain, the nitrate of soda being given in the spring of the year as a top dressing. The average of the 50 fields gave the following results :—

Average of Unmanured Plots.	Superphosphate.	Superphosphate and Sulphate of Ammonia.	Superphosphate and Nitrate of Soda.
Tons.	Tons.	Tons.	Tons.
1·46	2·26	2·66	2·55

From these figures sulphate of ammonia has produced a little more than 1-10th of a ton of hay more than an equal quantity of nitrate of soda. The superiority of the sulphate as a nitrogenous fertilizer is confirmed by tests carried out on 23 out of the 50 fields (Table C), where larger and smaller applications than 1 cwt. have been used with equal quantities of superphosphate. These results are given on Plots 16, 18 and 19 of Table C; they are here repeated. They represent the average of 23 fields.

YIELDS PRODUCED BY

	Tons.		Tons.		Tons.
1 cwt. superphosphate and ½ cwt. sulphate of ammonia	2·59	2 cwt. superphosphate and 1 cwt. sulphate of ammonia	2·87	2 cwt. superphosphate and 1½ cwt. sulphate of ammonia	2·96
1 cwt. superphosphate and ½ cwt. nitrate of soda ..	2·47	2 cwt. superphosphate and 1 cwt. nitrate of soda..	2·75	2 cwt. superphosphate and 1½ cwt. nitrate of soda ..	2·86
In favor of sulphate of ammonia ..	·12	.. .. ..	·12	.. .. ..	·10

The difference in favour of the sulphate of ammonia appears in every test, and taking the average is wonderfully regular.

THE EFFECT PRODUCED BY LIGHT, MEDIUM AND HEAVY DRESSINGS OF NITROGENOUS FERTILIZERS.

The effect of medium and heavy dressings can also be calculated from the figures given above. They are more striking and apparent, perhaps, with the slightly altered arrangement of the figures as given below :—

AVERAGE OF 23 FIELDS.

	Yield in Tons.	Gain due to Nitrogen.		Yield in Tons.	Gain due to Nitrogen.
2 cwt. superphosphate ..	2·52		2 cwt. superphosphate..	2·52	
2 cwt. superphosphate, with 1 cwt sulphate of ammonia	2·87	·35	2 cwt superphosphate, with 1 cwt nitrate of soda	2·75	·23
2 cwt. superphosphate, with 1½ cwt sulphate of ammonia	2·96	·44	2 cwt. superphosphate, with 1½ cwt. nitrate o soda	2·86	·34

The additional ½ cwt. in each test has produced a further increase of a little less than 1-10th of a ton in the case of sulphate of ammonia, and a little more than that quantity in the case of nitrate of soda. In neither instance, however, are the additional yields sufficiently heavy to make the larger application a profitable one. Lighter applications of a nitrogenous manure were not made with the 2 cwt. of superphosphate, although it might now be regretted that this was not

done. Lighter applications were, however, made with a smaller quantity (1 cwt.) of superphosphate, and interesting results have followed. They are here given.

YIELDS PRODUCED BY

	1 cwt. Superphosphate.	1 cwt. Superphosphate and ½ cwt. Sulphate of Ammonia.	1 cwt. Superphosphate and ½ cwt. Nitrate of Soda.
	Tons.	Tons.	Tons.
Average of 23 fields	2·23	2·59	2·47
Gain due to nitrogen ..	.. .. ..	·36	·24

These figures reveal a vastly greater relative operative effect on the part of a small application of nitrogenous manure in combination with a lighter phosphatic application than of a large nitrogenous dressing in conjunction with larger phosphatic applications. In fact the ½ cwt. of sulphate of ammonia and nitrate of soda, applied with 1 cwt. of superphosphate, has given the same increase in yield as 1 cwt. given with twice the quantity of superphosphate.

INCREASES PRODUCED BY

	Tons.		Tons.
½ cwt. sulphate of ammonia with 1 cwt. superphosphate ..	·36	½ cwt. nitrate of soda with 1 cwt. superphosphate	·24
1 cwt. sulphate of ammonia with 2 cwt. superphosphate ..	·35	1 cwt. nitrate of soda with 2 cwt. superphosphate	·23

The ½ cwt. of sulphate of ammonia in conjunction with 1 cwt. of superphosphate has, taking the average of 23 fields, given an increased yield of 1 ton to the acre—a larger return than that obtained from 3 cwt. of superphosphate alone, and at a less outlay—the cost for this application being about 12s. 3d. per acre. The results are of great value to the farmer as indicating the advisability of applications, in this form of combination, very materially smaller than those formerly considered necessary. That sulphate of ammonia will, under all conditions, prove more effective used in equal quantities than nitrate of soda, is to be doubted. In 50 cases only out of the 50 fields included in Table A are the increased yields from sulphate of ammonia larger than they are from nitrate of soda, and it was observed during the experiments that weather conditions, defective drainage, time of application and other points were factors largely influencing the relative effective power of each. Under certain soil conditions, such as defective drainage, excess of moisture, as well as unfavourable temperature conditions preventing the crop benefiting to an appreciable extent from the presence of sulphate of ammonia, the nitrate, applied in the spring, appeared to produce better results. This was particularly evident in the Allansford fields. It was also

observed, on the other hand, that the very heavy rains of the spring, following in instances immediately after the application of the nitrate to a number of crops, interfered with results—the returns from such fields, following from the nitrogen application, being lower than those from other fields not similarly affected. It may however, I think, be accepted that, with the absence of conditions tending to seriously check the crop through the winter, sulphate ammonia will give returns slightly higher than equal quantities of nitrate of soda. All crops treated with the first manure had stooled much better than any of the other plots not similarly treated.

The Effect of Potash.

Taking the average figures of the first year's experiments (season 1902-3) potash appeared to show some effect, but hardly, with few exceptions, to an extent covering the cost of the application, more especially where used in addition to the phosphatic and nitrogenous combination which has proved so effective in the experiments of both years. With phosphoric acid only, potash showed a more marked but still relatively small effect. The two years' returns indicating the effect of potash are given below :—

Yields Produced by

—	2 cwt. Superphosphate.	2 cwt. Superphosphate, 2-3rd cwt. Potash Chloride.	2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia.	2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia, 2-3rd cwt. Potash Chloride.
	Tons.	Tons.	Tons.	Tons.
Season 1902-3, Average of 30 fields	2·32	2·54	2·89	2·96
Season 1903-4, Average of 50 fields	2 26	2·31	2·66	2·69

It will be seen from these figures that in the first year's experiments a further addition of potash to the phosphatic and nitrogenous fertilizer resulted in an increased yield of only ·07 tons per acre, while in the last year's tests the increased yield was still less, amounting to ·03 tons only. It must be here remarked, as already shown in Table B, that on a number among the 50 fields, potash chloride was replaced by potash sulphate.

Additional Tests Showing the Slight Effect of Potash Manuring.

Reference to Tables B and C will indicate a comprehensive system of tests devised with the object of discovering the extent of the effective action of potash as a fertilizer. As with nitrogen, combinations were tried with the two forms of phosphoric acid as well as with the third remaining ingredient, forming a complete manure. As evident in the following figures, all the results obtained confirm the

very small response of Southern soils generally to potassic applications :—

YIELDS PRODUCED BY

	2 cwt. Superphosphate.	2 cwt. Superphosphate with Potash	In favor of Potash.
Average of 27 fields (Table B)	2·04 tons.	2·08 tons.	·04 tons.
	2 cwt. Thomas Phosphate	2 cwt. Thomas Phosphate with Potash.	In favor of Potash.
Average of 27 fields (Table B)	1·83 tons.	1·88 tons.	·05 tons.

From these figures it will be seen that in combination with a phosphatic manure, potash, in the quantity used, has shown as a maximum effect an increase of 1 cwt. only of hay to the acre. This slight effective action of potash is again confirmed by the returns showing the addition of an equal quantity of potash to combinations of the two phosphatic fertilizers with nitrogen.

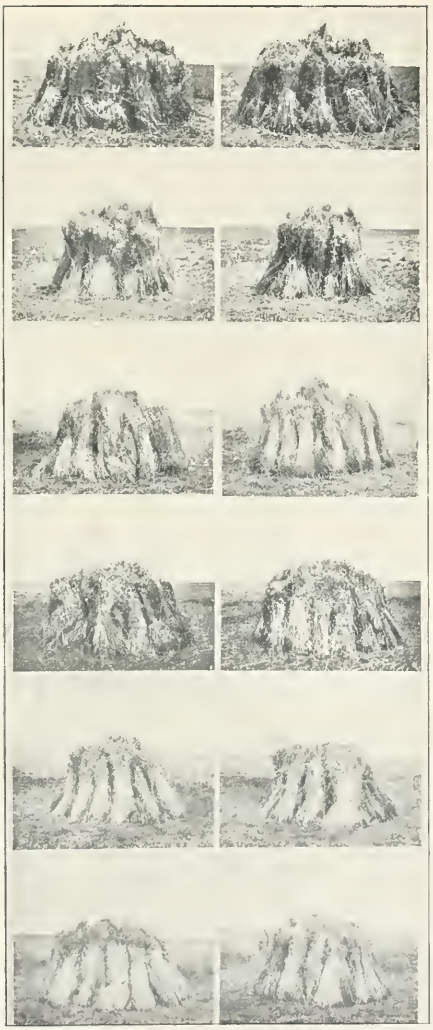
2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia.	2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia with Potash.	In favor of Potash.
2·46 tons	2·51 tons.	·05 tons.
2 cwt Thomas Phosphate, 1 cwt Nitrate of Soda	2 cwt. Thomas Phosphate, 1 cwt. Nitrate of Soda with Potash.	In favor of Potash.
2·13 tons.	2·20 tons.	·07 tons

THE EFFECT OF LIGHT APPLICATIONS OF POTASH.

It will be remembered that light applications of a nitrogenous fertilizer in combination with small quantities of a phosphatic manure gave far heavier relative increases in yield than heavier applications. The same appears to take place with potash also, although to a less degree. The results of these tests are embraced in the returns of Table C. Potash has been given exclusively in the form of sulphate in this case.

	2 cwt. Superphosphate,	2 cwt. Superphosphate, 2-3rd cwt. Potash Sulphate	In favor of Potash.
Average of 23 fields ..	2·52 tons.	2·58 tons.	·06 tons.
	1 cwt. Superphosphate.	1 cwt. Superphosphate, 1-3rd cwt. Potash Sulphate	In favor of Potash
Average of 23 fields ..	2·23 tons.	2·32 tons.	·09 tons.

1 2



NON-EFFECT OF POTASH on $\frac{1}{20}$ acre plots

(1) Superphosphate and nitrate of soda.

(2) Potash chloride in addition to superphosphate and nitrate of soda.

The Poisonous Effect of Potash Chloride.

It is well known that the chloride of potash, as other chlorides, is capable of exercising a poisonous effect upon plants after a certain degree of concentration. Certain facts in connection with results obtained in earlier Victorian field experiments from the use of potash chloride suggested the advisability of comparative tests being made with the sulphate and chloride of potash, both in combination with a phosphatic manure and with sulphate of ammonia. A very fine series of experiments to determine the poisonous action of chlorides on plant life has recently been carried out at the Rhode Island Experiment Station, U.S.A. In the "Fifteenth Annual Report" of this Station appears the following:—"The results of numerous experiments in the Massachusetts Experiment Station indicate further that sulphate of ammonia should not be used in connection with fertilizers which contain chlorides, such, for example, as muriate of potash or kainit. If so used there is likely to be an interchange of acids and bases; the sulphuric acid which was a part of the sulphate of ammonia leaves the ammonia and combines with potash or soda, and the chlorine combines with ammonia forming chloride of ammonia. This compound is highly injurious to plants." The outcome of the Rhode Island experiments is expressed in the following words, "These results lead to the belief that chlorides of calcium magnesium and ammonia in reasonable quantities are not likely to prove poisonous to plants, so long as carbonate of lime or other basic substances are present in sufficient quantities to prevent the occurrence of an acid reaction, or at least a strong acid reaction of the soil. Such being the case, it would seem more rational to teach the farmers to look out for the reaction of their soils by testing it with blue litmus paper, and to advise them to correct undue acidity by using lime or wood ashes than to discourage unconditionally the use of combinations of manures likely to give rise to ammonium chloride or other chlorides, which, of themselves, may be beneficial rather than injurious, if the soil is in the best condition for the production of the majority of farm crops."

From the results of the Victorian field tests last year, it would appear that, in reasonable quantity, the chloride of potash will exercise no deleterious effect on Southern soils generally, although there are instances, owing probably to reasons similar to those advanced in the Rhode Island experiments, where this might take place. Some of the Bunyip soils appear to offer an illustration of this.

The Results from the Sulphate and Chloride of Potash Combined.

Reference to the returns of the 27 fields of Table B will show that, on 13 out of the number, the sulphate was given instead of the chloride of potash. The average yields of these 13 fields, as also the average yields of the remaining 14, indicating the effect of the two forms of potash fertilization work out as follows:—

	2 cwt. Superphosphate.	2 cwt. Superphosphate with Potash.	In favor of Potash.	2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia.	2 cwt. Superphosphate, 1 cwt. Sulphate of Ammonia with Potash.	In favor of Potash.
	Tons.	Tons.	Tons.	Ton	Tons.	Tons.
Average yields of 13 fields, Potash in sulphate form ..	1·83	1·88	·05	2·27	2·30	·03
Average yields of 14 fields, Potash in chloride form ..	2·23	2·27	·04	2·64	2·70	·06

	2 cwt. Thomas Phosphate.	2 cwt. Thomas Phosphate with Potash.	In favor of Potash.	2 cwt. Thomas Phosphate, 1 cwt. Nitrate of Soda.	2 cwt. Thomas Phosphate, 1 cwt. Nitrate of Soda with Potash.	In favor of Potash.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Average yields of 13 fields, Potash in sulphate form ..	1·69	1·74	·05	1·99	2·10	·11
Average yields of 14 fields, Potash in chloride form ..	1·97	2·01	·04	2·26	2·30	·04

There is nothing in these results to show a superiority of the sulphate form of potash over the chloride using equal quantities, or, to put it another way, to indicate that any bad effects have followed the use of chloride, either in combination with a phosphatic manure only, or with the further addition of sulphate of ammonia. The results add fresh confirmatory evidence on the relatively small effect potash will exercise in comparison with phosphatic and nitrogenous fertilizers in increasing the hay yields of Southern Victoria.

Further Comparisons between the Two Forms of Potash.

Additional evidence, indicating that, generally speaking, the combination of the chloride of potash with sulphate of ammonia will not result deleteriously, is present in the average returns of Table C. The average results of 23 fields in these returns show that the sulphate and chloride of potash, used each in equal quantities with like amounts of sulphate of ammonia, have given identically the same yields.

Average yields of 23 fields ..	2-3rd cwt. potash sulphate, 1 cwt. sulphate of ammonia.	1·80 tons.
Average yields of 23 fields ..	2-3rd cwt. potash chloride, 1 cwt. sulphate of ammonia.	1·80 tons.

The returns of the 14 fields referred to again support this. In these tests sulphate of ammonia and potash chloride in combination have been compared with equal quantities of nitrate of soda, and the same potash salt also used together.

The average returns of the 14 fields were as follows :—

1 cwt. sulphate of ammonia, 2-3rd cwt. potash chloride	1·84 tons.
1 cwt. nitrate of soda (given in spring), 2-3rd cwt. potash chloride ..	1·60 tons.

The Districts Grouped.

The results in Tables A, B and C which have been discussed have been averaged irrespective of districts. In the appendix the results of the fields in each district will be found grouped and averaged separately. A study of these returns will enable the farmers of each district where the tests were carried out to secure evidence of what was obtained in their particular neighbourhood, without considering the average results from returns obtained generally. With few exceptions, all the conclusions drawn from the general average may apply with equal force to each separate district. Where there are apparent differences these will find explanation by considering the points already referred to in this paper. In studying the fields individually, apparent irregularities in the action of similar manures in the different plots of the one field will, perhaps, suggest themselves, but in interpreting the results of a field, the results on the whole must be considered, and not an exaggerated attention given to what at times might appear as contradictions in one or two plots. The great differences in the various unmanured plots of a single field will suggest the possible existence of differences in natural productivity just as great in adjoining manured plots, and will explain much of what to the casual observer may present the appearance of contradiction. It is just here that the value of the average of large numbers makes itself apparent. In such averages the effect of the exceptional is largely lost. This, of course assumes that all the soils in a district present requirements pretty well similar, and this undoubtedly is the case with regard to the great bulk of soils considered to require fertilizers in Southern Victoria, as far as hay crops at any rate are concerned. In certain cases, the irregularity of one or a number of the plots in a field has been brought about by other causes, such as excessive wet in those parts. In a few other cases, as for instance where the drill might have missed, and where corrections were justifiably allowable, these losses have been allowed for on estimates made upon the remainder of the growing crop not so affected.

Summary.

1. The effect of phosphatic fertilizers on the Southern soils included in the range of the experiments is most pronounced.

2. In the comparative tests between the three phosphatic forms of superphosphate, Thomas phosphate and bonedust, results point to an undoubted superiority on the part of the first manure, both in the larger yields produced where equal quantities of the three have been used, and the larger accruing money value of the increase in produce over the cost incurred.

3. Bonedust, owing to an improvement in mechanical condition, and probably to its nitrogen content and the response of Southern

soils to this ingredient, has, used in equal quantity with the two other forms, produced increased yields larger than Thomas phosphate and almost equal to superphosphate. Owing however to its much higher price, it cannot compare from the point of view of resulting profits with the second manure.

4. Thomas phosphate fails to show, in the increased yields produced by the use of equal quantities, figures equal to those of bonedust, but owing to its much lower cost the difference in resulting profits is not so great as the first consideration would appear to indicate. With an improvement in quality equalling earlier shipments, it is probable the resulting profits would equal, or perhaps exceed, those from bonedust at present market rates.

5. Numerous comparative tests between equal quantities of superphosphate and Thomas phospate, both alone and in combination with nitrogenous and potassic manures, establish firmly the greater effective power of the first fertilizer, and although the market rates for Thomas phosphate are lower than those ruling for the great bulk of superphosphates, the profits resulting from the latter are very considerably in excess of those of the former. It should, however, be noted that the analysis of last year's Thomas phosphate showed a grade of that manure below the standard formerly obtainable on the market, and much below what European analysis shows it ought to be, and it seems probable that with an improvement in quality it will compare very favourably with superphosphate.

6. Nitrogenous manures find an almost universal response on Southern soils so far experimented on, and have resulted generally in increased yields sufficiently large to give substantial profits.

7. In the results of the tests between the nitrate and ammonia form, there seems sufficient evidence, using equal quantities, to justify the premier position in effective power being given to sulphate of ammonia.

8. In the tests to decide the effect of light, medium and heavy dressings of a nitrogenous manure, it appears that the progressive increases in yield following heavier applications are not sufficiently marked to justify the larger quantities used.

9. Increased yields appear to follow a light application of a phosphatic fertilizer (1 cwt. per acre), used in combination with a light application of a nitrogenous manure ($\frac{1}{2}$ cwt. per acre), superior to those produced by a heavy dressing of a purely phosphatic fertilizer.

10. Medium and heavy dressings of a nitrogenous fertilizer (1 cwt. and $1\frac{1}{2}$ cwt.) in combination with medium dressings of a phosphatic manure (2 cwt.) show a considerably reduced effect, relatively, to light applications in combination with light phosphatic dressings.

11. The effect of potash generally has not been sufficiently pronounced to merit marked consideration.

12. Where the two forms of the sulphate and chloride of potash have been used, there has been a striking regularity in the operative

effect shown by each, both in combination with superphosphate and Thomas phosphate alone, as well as with the combination of each of these phosphatic forms with a nitrogenous manure.

13. Chloride of potash used with sulphate of ammonia—a combination in which poisonous compounds resulting under certain conditions are supposed to act injuriously to plant life—appears, with a few exceptions, to have produced results closely corresponding to those obtained from a combination of potash sulphate with the same ammonia salt.

14. The financial aspects of the results of the experiments are most satisfactory, and, taking the mean of the extreme prices ruling at different periods for the crop experimented on as a basis for calculation, it appears that for an expenditure of from 12s. to 15s. per acre in manure, increased returns of a money value, taking a low estimate, of from 30s. to 40s. might be expected. These remarks are not, of course, intended to apply to soils of a well recognised exceptionally high fertility requiring no fertilization. The productivity of his farm will indicate to each farmer the necessity or otherwise of considering in his case the questions here dealt with.

RESULTS FROM THE EXPERIMENTAL HAY CROPS

Manures given per acre.	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Sulphate.	1 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Sulphate.	No Manure.	⅔ cwt. Potash Sulphate. 1 cwt. Sulphate of Ammonia.
No. of Plots	1	2	3	4	5	6	7	8	9
Yield per acre :— ..	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
J. Collins, Irrewarra	1·92	·96	3·29	3·25	1·03	3·62	2·85	1·10	1·37
Jno. Wylie, Turkeith	2·68	1·89	2·65	3·01	1·63	3·10	2·87	1·74	1·97
Jno. Wylie, Turkeith	2·75	1·69	3·25	3·53	1·57	3·20	2·70	1·69	1·71
W. T. Fish, Yeo	3·41	1·40	3·57	3·77	1·50	4·15	3·07	1·71	1·74
W. Parker, Yeo	2·53	·75	2·39	1·98	·53	2·90	1·50	·60	1·04
Average of the 5 fields ..	2·65	1·33	3·03	3·11	1·25	3·39	2·59	1·36	1·56
Increase due to manures ..	1·32	—	1·70	1·86	—	2·14	1·23	—	·20

RESULTS OF EXPERIMENTAL HAY CROPS IN THE

Name of Experimenter.	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt Ordinary Superphosphate.	No Manure.	2 cwt. Thomas Phosphate.	2 cwt. Bonedust.	No Manure.	2 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Chloride.
	1	2	3	4	5	6	7	8	9
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
W. Wheildon, Longwarry ..	1·10	·84	1·17	1·05	·75	·99	1·27	·79	1·07
D. Kett, Longwarry	1·96	1·67	1·78	1·58	1·44	1·32	1·40	1·22	1·58
W. Baird ,, ...	1·67	1·19	1·78	1·81	1·52	1·73	2·08	1·65	2·02
A. Williams, Bunyip	2·34	1·94	2·57	2·75	1·72	2·39	2·43	1·41	2·28
W. McSkimming, ,, ...	3·37	2·75	3·64	3·84	2·90	3·50	4·07	2·90	4·55
T. Stafford, ,, ...	·98	·70	1·07	1·06	·63	·87	·92	·62	·93
W. Casement, ,, ...	1·64	·82	2·12	1·99	·78	1·62	1·32	·69	1·46
W. Forsyth, ,, ...	·75	·65	1·00	1·12	·72	·82	1·12	·64	1·19
T. Maisey, Longwarry.. ..	·75	·33	·90	1·06	·41	1·03	1·16	·35	1·17
E. S. Hill, Garfield	2·02	1·33	2·27	2·36	1·14	1·67	1·81	1·14	1·98
J. Jenkins, Koo-Wee-Rup ..	2·02	1·82	3·19	2·60	1·65	2·27	2·58	1·70	3·17
Average of the 11 fields ..	1·69	1·27	1·95	1·92	1·22	1·65	1·83	1·19	1·94

IN THE COLAC DISTRICT. SEASON 1903.

$\frac{3}{4}$ cwt. Potash Chloride. 1 cwt. Sulphate of Ammonia.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Sulphate of Ammonia.	1 cwt. Ordinary Superphosphate. $\frac{1}{2}$ cwt. Sulphate of Ammonia.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring).	1 cwt. Ordinary Superphosphate. $\frac{1}{2}$ cwt. Nitrate Soda (applied Spring).	No Manure.	2 cwt. Ordinary Superphosphate. $1\frac{1}{4}$ cwt. Sulphate of Ammonia.	2 cwt. Ordinary Superphosphate. $1\frac{1}{2}$ cwt. Nitrate Soda (applied Spring).	No Manure	2 cwt. Ordinary Superphosphate. $\frac{3}{4}$ cwt. Potash Sulphate. 1 cwt. Sulphate of Ammonia.	2 cwt. Ordinary Superphosphate. $\frac{3}{4}$ cwt. Potash Sulphate. 1 cwt. Nitrate Soda (applied Spring).	No Manure.	1 cwt. Ordinary Superphosphate. $\frac{3}{4}$ cwt. Potash Sulphate. $\frac{1}{2}$ cwt. Nitrate Soda (applied Spring).
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1·33	1·10	3·48	2·62	·90	3·01	2·16	·78	3·13	2·21	·81	3·33	3·68	·83	2·51
1·87	·88	3·48	3·29	1·74	3·25	2·91	1·87	3·69	3·41	2·57	3·83	3·11	1·76	2·98
1·70	1·50	3·47	2·65	1·39	3·40	2·68	1·39	3·71	3·34	1·33	3·73	3·23	1·33	2·94
1·69	1·74	4·20	3·27	1.62	4·21	3·36	1·58	4·37	4·00	1·49	4·13	3·68	1·41	3·34
·93	·64	3·34	2·82	·64	3·06	2·40	·71	2·89	3·19	·64	2·91	2·89	·64	1·88
1·50	1·17	3·59	2·93	1·25	3·38	2·70	1·26	3·55	3·23	1·36	3·58	3·31	1·19	2·73
·33	—	2·42	1·68	—	2·13	1·44	—	2·29	1·87	—	2·22	2·12	—	1·54

BUNYIP, LONGWARRY AND GARFIELD DISTRICT. SEASON 1903.

2 cwt Thomas Phosphate. $\frac{3}{4}$ cwt. Potash Chloride.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Sulphate Ammonia.	2 cwt. Thomas Phosphate. 1 cwt. Nitrate Soda (applied Spring).	No Manure.	2 cwt Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring).	1 cwt Sulphate Ammonia. $\frac{3}{4}$ cwt. Potash Chloride.	No Manure.	1 cwt. Nitrate Soda (applied Spring). $\frac{3}{4}$ cwt. Potash Chloride.	2 cwt. Ordinary Superphosphate. 1 cwt Sulphate of Ammonia. $\frac{3}{4}$ cwt. Potash Chloride.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring). $\frac{3}{4}$ cwt. Potash Chloride.	2 cwt. Thomas Phosphate. $\frac{3}{4}$ cwt. Potash Chloride. 1 cwt. Nitrate Soda (applied Spring).	No Manure	3 cwt. Ordinary Superphosphate. 1 cwt. Potash Chloride. $1\frac{1}{2}$ cwt. Nitrate Soda (applied Spring).
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1·00	·62	1·75	1·36	·65	1·82	1·12	·67	·65	1·68	·69	1·58	1·49	·69	1·94
1·45	1·09	2·03	1·93	1·37	1·73	1·72	1·25	1·73	2·44	1·30	2·37	2·28	1·58	2·83
1·62	1·57	2·52	2·36	1·50	2·40	1·86	1·53	1·68	2·39	1·45	2·27	2·29	1·39	2·75
2·39	1·74	2·90	2·75	1·63	2·69	2·05	1·46	1·80	2·69	1·50	2·27	2·31	1·62	2·69
4·13	2·93	4·30	3·25	2·66	3·31	3·21	2·66	2·50	5·50	2·66	4·03	4·27	2·90	3·75
·95	·44	1·40	1·40	·75	1·45	1·27	·76	·89	1·53	·79	1·02	1·12	·82	1·59
1·28	·64	2·10	1·78	·71	1·46	·80	·66	1·01	1·82	·60	1·57	1·51	·64	1·73
·83	·72	1·74	1·33	·59	1·86	1·12	·60	·92	1·72	·64	·88	·97	—	—
1·17	·37	1·58	1·16	·35	1·56	·51	·40	·50	1·50	·39	1·28	1·24	·39	1·51
1·83	1·07	2·50	1·67	1·12	1·94	1·34	1·00	1·29	2·21	·87	1·54	1·57	·81	2·32
2·35	1·30	3·36	2·40	1·37	3·01	2·32	1·67	1·55	3·26	1·66	2·94	2·91	1·80	3·55
1·72	1·13	2·38	1·94	1·15	2·10	1·57	1·14	1·22	2·24	1·14	1·99	1·99	1·26	2·46

RESULTS FROM EXPERIMENTAL HAY CROPS

	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Thomas Phosphate.	2 cwt. Bonedust.	No Manure.	2 cwt Ordinary Superphosphate. ⅔ cwt. Potash Sulphate.
	1	2	3	4	5	6	7	8	9
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
J. Dalton, Yambuk	—	1·74	2·40	1·90	1·30	1·65	1·90	1·51	1·87
D. O'Shannassey, Yambuk ..	·35	·33	·44	·40	·33	·42	·47	·28	·38
R. Lewis, Yambuk	2·03	1·75	2·22	2·60	1·76	2·04	2·00	1·82	2·42
Average yield per acre of 3 fields	1·21	1·27	1·68	1·63	1·13	1·37	1·45	1·20	1·55

	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Sulphate.	1 cwt. Ordinary Superphosphate. ⅔ cwt Potash Sulphate.	No Manure.	⅔ Potash Sulphate 1 cwt. Sulphate of Ammonia.
	1	2	3	4	5	6	7	8	9
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Madden Bros, Yambuk ..	2·62	1·54	2·90	2·41	1·41	2·84	2·04	1·47	1·96
P. Madden ,, ...	1·53	1·41	1·75	1·23	1·35	1·69	1·91	1·03	1·26
Average yield per acre of 2 fields	2·07	1·47	2·32	1·82	1·38	2·26	1·97	1·25	1·61

IN THE YAMBUK DISTRICT—SEASON 1903.

2 cwt. Thomas Phosphate. ⅔ cwt Potash Sulphate.	No Manure	2 cwt. Ordinary Superphosphate. 1 cwt Sulphate of Ammonia.	2 cwt Thomas Phosphate 1 cwt. Nitrate Soda (applied Spring).	No Manure.	2 cwt Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied Spring).	1 cwt Sulphate of Ammonia ⅔ cwt. Potash Sulphate	No Manure.	1 cwt Nitrate Soda (applied Spring). ⅔ cwt. Potash Sulphate.	2 cwt. Ordinary Superphosphate. 1 cwt Sulphate of Ammonia. ⅔ cwt Potash Sulphate.	No Manure.	2 cwt Ordinary Superphosphate. 1 cwt Nitrate Soda (applied Spring). ⅔ cwt. Potash Sulphate	2 cwt. Thomas Phosphate. ⅔ cwt. Potash Sulphate. 1 cwt. Nitrate Soda (applied Spring).	No Manure.	3 cwt. Ordinary Superphosphate. 1 cwt. Potash Sulphate. 1½ cwt. Nitrate Soda (applied Spring).
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1·69	1·37	2·56	2·30	1·47	2·21	1·75	1·59	1.92	2·06	1·50	2·06	2·21	1·32	2·28
·35	·37	·57	1·00	·42	1·14	·53	·44	·72	·75	·40	1·09	1·06	·44	1·16
2·01	1·88	2·91	2·32	1·56	2·50	1·49	1·63	1·99	2·86	1·63	2·45	2·55	1·67	2·61
1·35	1·20	2·01	1·87	1·15	1·95	1·25	1·22	1·54	1·89	1·17	1·86	1·94	1·14	2·01

⅔ cwt. Potash Chloride. 1 cwt. Sulphate of Ammonia.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt. Sulphate of Ammonia.	1 cwt. Ordinary Superphosphate. ⅓ cwt. Sulphate of Ammonia	No Manure	2 cwt. Ordinary Superphosphate. 1 cwt. Nitrate Soda (applied in Spring).	1 cwt Ordinary Superphosphate. ½ cwt Nitrate Soda (applied in Spring).	No Manure.	2 cwt. Ordinary Superphosphate. 1½ cwt Sulphate of Ammonia	2 cwt. Ordinary Superphosphate. 1½ cwt. Nitrate Soda (applied in Spring).	No Manure.	2 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Sulphate. 1 cwt. Sulphate of Ammonia.	2 cwt. Ordinary Superphosphate. ⅔ Potash Sulphate. 1 cwt. Nitrate Soda (applied in Spring).	No Manure.	1 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Sulphate. ½ cwt. Nitrate Soda (applied in Spring).
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1·63	1·51	2·95	2·35	1·41	2·87	2·63	1·57	3·30	3·41	1·25	2·94	3·37	1·48	2·88
1·83	1·08	2·24	2·02	1·07	2·18	1·90	1·09	3·21	2·71	1·31	2·78	2·79	·97	1·85
1·73	1·29	2·59	2·18	1·24	2·52	2·26	1·33	3·25	3·06	1·28	2·86	3·08	1·22	2·36

RESULTS FROM EXPERIMENTAL HAY CROPS

	1 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Ordinary Superphosphate.	3 cwt. Ordinary Superphosphate.	No Manure.	2 cwt. Thomas Phosphate.	2 cwt. Bonedust.	No Manure.	2 cwt. Ordinary Superphosphate. ⅔ cwt. Potash Chloride.
	1	2	3	4	5	6	7	8	9
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
J. Killeen, Mepunga	1·43	1·23	1·36	1·40	1·05	2·02	1·67	1·43	1·75
Jas. Rae, Naringal	1·58	1·52	2·22	2·68	1·40	1·96	2·36	1·40	2·44
J. Stanhope, Mepunga ..	1·76	1·34	2·18	1·91	1·52	1·87	2·08	1·80	2·21
H. T. Allwood, Mepunga ..	1·48	1·34	1·45	1·53	1·23	1·20	·93	·90	1·48
W. Taylor, Allansford ..	3·61	2·80	4·46	4·14	2·80	3·00	3·54	2·70	3·68
D. Rae, Cudgee	2·88	2·50	2·34	2·81	2·20	2·80	2·54	2·24	3·14
J. Trigg, Senr., Mepunga ..	1·93	1·35	2·55	1·80	1·70	2·03	2·48	1·04	2·31
T. Drake, Allansford ..	1·90	1·41	2·10	2·45	1·38	1·82	2·17	1·21	1·90
Geo. White ,, ..	1·27	1·14	1·50	1·64	1·00	1·80	1·52	1·47	1·67
C. Taylor ,, ..	·92	·78	·82	·71	1·13	1·53	1·47	1·14	1·45
Average of 10 fields ..	1·87	1·54	2·09	2·10	1·54	2·00	2·07	1·53	2·20

IN THE ALLANSFORD DISTRICT. SEASON 1903.

2 cwt. Thomas Phosphate. ⅔ cwt. Potash Chloride.	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt Sulphate of Ammonia.	2 cwt. Thomas Phosphate 1 cwt. Nitrate Soda (applied in Spring).	No Manure.	2 cwt. Ordinary Superphosphate. 1 cwt Nitrate Soda (applied in Spring).	1 cwt Sulphate of Ammonia. ⅔ cwt Potash Chloride.	No Manure.	1 cwt. Nitrate Soda (applied in Spring). ⅔ cwt. Potash Chloride.	2 cwt Ordinary Superphosphate. 1 cwt. Sulphate of Ammonia. ⅔ cwt. Potash Chloride.	No Manure.	2 cwt Ordinary Superphosphate. 1 cwt. Nitrate Soda applied in Spring). ⅔ cwt. Potash Chloride.	2 cwt. Thomas Phosphate. 1 cwt. Potash Chloride. ⅔ cwt. Nitrate Soda (applied in Spring).	No Manure.	3 cwt. Ordinary Superphosphate. 1 cwt. Potash Chloride. 1½ cwt. Nitrate Soda (applied in Spring).
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
1·43	1·37	1·89	2·18	1·40	2·35	1·88	1·33	1·65	1·81	1·20	2·08	1·81	1·28	2·14
2·04	1·40	2·99	1·75	1·38	2·51	1·96	1·36	1·60	2·76	1·39	2·68	2·36	1·42	2·72
1·51	1·64	2·64	2·21	1·41	2·55	1·06	1·00	1·50	2·84	1·43	2·51	2·30	1·30	3·16
1·67	1·40	1·70	1·77	1·43	2·00	1·65	1·60	1·72	1·81	1·20	2·09	1·91	1·37	2·25
3·64	3·28	3·44	3·56	2·62	3·84	3·39	2·82	3·10	3·88	2·40	3·28	3·10	2·00	3·10
3·04	2·18	3·35	3·50	2·12	3·91	3·00	2·50	2·00	3·73	2·71	3·92	3·74	2·43	4·43
2·13	1·00	2·73	2·26	1·30	2·56	1·64	1·45	1·45	2·72	1·04	2·34	2·16	1·45	3·43
2·03	1·14	2·62	2·37	1·27	2·76	·62	1·26	1·26	2·96	1·26	2·88	2·60	1·25	2·92
1·47	1·17	1·47	1·60	·88	1·84	1·30	1·13	1·34	1·61	1·08	1·88	1·82	1·16	2·27
1·63	1·22	2·00	2·05	1·17	1·76	1·44	·80	1·73	1·56	1·02	1·43	1·60	·87	1·86
2·05	1·58	2·48	2·32	1·49	2·60	1·79	1·52	1·73	2·56	1·47	2·50	2·34	1·45	2·82

RESULTS FROM EXPERIMENTAL HAY CROPS IN THE GEELONG DISTRICT. SEASON 1903.

Name and Place of Farmer.	Average yield of 8 Unmanured Plots.	First Comparison. 1 cwt. Ordy. Superphosphate.	1 cwt. Ordy. Superphosphate. ½ cwt. Sulphate Ammonia.	1 cwt. Ordy. Superphosphate. ½ cwt. Nitrate Soda (applied in Spring)	1 cwt. Ordy. Superphosphate. ⅓ cwt. Potash Sulphate. ½ cwt. Nit. Soda (applied Spring)	1 cwt. Ordy. Superphosphate. ⅓ cwt Potash Sulphate.	2 cwt. Ordy. Superphosphate.	Second Comparison. 2 cwt Ordy. Superphosphate. 1 cwt Sulphate Ammonia.	2 cwt. Ordy. Superphosphate. 1 cwt. Nit. Soda (applied Spring)	2 cwt. Ordy. Superphosphate. 1½ cwt. Sulphate Ammonia.	2 cwt. Ordy. Superphosphate. 1½ cwt. Nit. Soda (applied Spring)	2 cwt. Ordy. Superphosphate. ⅔ cwt. Potash Sulphate. 1 cwt. Sulphate Ammonia.	2 cwt. Ordy. Superphosphate. ⅔ cwt. Potash Sulphate. 1 cwt. Nit. Soda (applied Spring)	2 cwt. Ordy. Superphosphate. ⅔ cwt. Potash Sulphate.	⅔ cwt. Potash Sulphate. 1 cwt. Sulphate Ammonia.	⅔ cwt. Potash Chloride. 1 cwt. Sulphate Ammonia.	3 cwt. Ordy. Superphosphate.
Original No. of Plot in field ..		1	13	16	24	7	3	12	15	18	19	21	22	6	9	10	4
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
W. Muhlebach, Batesford ..	2·14	2·33	2·73	2·61	2·79	2·39	2·62	2·67	2·95	2·66	3·10	1·98	3·15	2·61	2·11	2·18	2·56
W. Scott, Connewarre	1·23	1·40	1·78	1·70	1·62	1·35	1·66	2·00	2·06	2·38	2·14	1·98	2·14	1·31	1·53	1·87	1·38
W. Thomas, Herne Hill ..	2·30	2·41	3·26	2·88	2·85	2·70	2·89	2·87	2·66	2·91	2·92	3·37	2·82	2·77	2·14	2·85	3·03
C. J. Tadgell, Moolap	2·52	2·83	3·09	2·96	2·92	3·08	2·63	2·37	3·04	3·23	3·13	2·78	3·21	2·66	2·47	2·87	2·69
R Blyth, Barwon Heads ..	·95	1·72	1·82	2·03	1·80	1·77	2·12	2·17	2·18	1·97	1·85	2·00	1·85	1·91	·90	·99	2·21
W. O'Brien, Cowies Creek ..	·99	1·56	2·39	1·89	2·30	1·17	1·65	3·24	2·26	1·79	3·41	2·62	2·60	1·50	1·22	1·23	1·60
W. E. Sutterby, Herne Hill ..	1·78	2·56	2·82	2·87	2·89	2·58	2·56	2·26	3·03	3·00	2·88	3·13	3·14	2·78	1·79	1·83	2·81
J. Larkin, Moolap	·89	1·44	1·63	1·53	1·68	1·64	1·37	2·01	1·83	1·93	1·60	2·06	1·68	1·64	1·45	1·25	1·94
J. Jinks, Curlewis	1·69	1·79	2·76	2·65	2·86	2·53	2·04	2·86	2·87	2·87	2·80	3·13	—	1·66	2·19	2·25	2·76
Paech Bros , Germanton ..	1·29	1·47	1·75	1·54	1·69	1·53	1·18	1·96	2·10	2·03	2·07	2·07	2·03	1·57	2·03	2·02	1·34
R. H. Sutterby, Moolap ..	1·97	2·04	2·31	2·46	2·52	2·10	2·09	2·38	2·44	2·88	2·54	2·27	2·71	1·98	1·97	1·93	1·79
S. McCann, Ceres	1·58	1·77	2·44	1·95	2·06	2·46	2·29	2·60	2·25	2·42	2·35	2·31	2·34	2·75	1·55	1·67	2·27
J. Robb, Geelong West ..	2·75	3·25	3·65	3·37	3·69	3·27	3·61	3·62	3·36	3·30	3·71	3·57	3·75	3·24	3·55	2·58	3·61
J. McCurdy, Geelong	1·17	1·85	2·38	2·12	2·57	1·92	2·60	2·72	1·92	3·77	2·60	3·18	2·74	2·51	1·14	1·10	2·93
Average yield in tons ...	1·60	2·03	2·48	2·32	2·44	2·17	2·23	2·55	2·49	2·65	2·65	2·61	2·62	2·20	1·86	1·90	2·35

DISEASES OF CEREALS: RUST AND TAKE-ALL IN WHEAT.*

By D. McAlpine.

It is a privilege to have the opportunity of addressing a body of producers whose interest it is to turn to the best account the various natural advantages which our soil and climate offer, and as a representative of one of the numerous branches which necessarily go to the making of an up-to-date Agricultural Department, I desire to lay before you some of the means whereby production may be increased and losses diminished.

The Agricultural Chemist has already shown you how, by the judicious application of manures in the right quantities, the ordinary yields may be considerably increased, and how in comparatively poor land crops may be grown to advantage which would otherwise be unprofitable. This however is one, but not the only one, of the numerous measures which the farmer may employ to obtain an increased return from the cultivation of the soil, and I will mention just a few of those which have given good results in connection with the experimental work carried out by the Pathologist's Branch.

Variety Tests.

It is a well known fact that among the numerous varieties, it may be of cereals, of fruit trees or vines, there are some better adapted to certain districts than others. The soil and climate, heat and moisture vary, and it should be one of the objects of the successful cultivator to study his surroundings and grow the particular varieties which give him the best return for labour expended. This, of course, can only be satisfactorily settled by actual trial, and the Department for a number of years past has been conducting experiments in this direction. There is an unlimited field here for experiment in order to determine the sorts best suited to our conditions, for in a comparatively young country like ours, with its vast possibilities of varied and extensive culture, there is plenty of room for the introduction of new varieties and the improvement of those already in existence.

As an example in connection with the hop industry, hop sets have been imported from California where the climate is somewhat similar to our own, and after a thorough trial an old and experienced hop grower writes:—"The introduction of the Californian hop to Victoria is, I feel confident, a step in the right direction, which ought to have been taken many years ago."

* An address delivered before the Kyneton Convention of Farmers and Producers, 30th June, 1904.

But it is mainly with wheat, oats and barley that I have been experimenting, and the results are very encouraging. In a wheat that is to replace some of those already grown, it is necessary at least to have rust resistance, early ripening, good yielding and milling qualities. Rerraf has so far fulfilled these conditions, and it was extensively distributed by the Department last season in small quantities. The celebrated Garton breeds of cereals have also been imported by the Director of Agriculture, and so far the Abundance oat and the Brewer's Favourite barley promise well.

It is most important to have a good malting barley, especially for the northern areas, and a more vigorous and better quality of seed is much to be desired.

Garton's No. 2 six-rowed barley was tried on a small scale, and found to be early and the grain very thin skinned. With reference to this barley, I am favoured with the following through Mr. Barrett, maltster, who takes a lively interest in the subject :—

"It may interest you to hear that we wrote to a friend of ours in England about this barley, and he said that, speaking to a very large barley grower in Mark Lane this morning (April 6th), 'there was a very small acreage of it grown in England last year, as the maltsters paid such low prices for it in consequence of its size, but the yield is higher per acre than the ordinary Chevalier.' Our friend also said, 'that one very large maltster told him that personally he liked the barley as it made very nice malt,' but here again the brewers objected to it because the malt was so small. Our friend also said 'that personally I have no doubt but later on this six-rowed barley will be the thing, as with careful cultivation it will reproduce in larger size, something between the big sizes and it, as the big sizes now develop to too great a size.' "

There can be no doubt of the value of testing the different varieties of wheat suited to particular districts, for each agricultural region with its distinct climate must stand on its own. This was strikingly shown in the experiments conducted in the Mallee for three successive seasons 1899-1901, where one of the crosses introduced (Outpost) yielded an average for the three years of 17 bushels 54 lbs. In 1901 when the total rainfall between dates of sowing and ripening was only 5·93 inches, Rerraf yielded at the rate of 10 bushels per acre, and the farmer who grew it wrote :—"Very few farmers will get an average yield of 4 bushels per acre, while some are barely getting back the quantity of seed sown. I got 10 bushels per acre of Rerraf off an exceptionally good 2-acre piece of fallowed land, and this is the best yield I have yet heard of."

Grasses for Fodder.

Another promising field in which experiments are being conducted is that of fodder plants and principally grasses. The importance to the dairying industry of having a good supply of succulent and nutritious feed is self-evident, and not only have our native grasses

to be looked after but there is plenty of scope for testing those imported from other lands. Many of our pastures require to be renewed, and the question arises as to the best grasses to stock them with.

There are some which withstand the drought and could be used as summer fodder, and others which thrive through the winter months in spite of the cold. It is only by actual trial under different conditions that these facts can be determined, and so small test plots consisting of about 100 varieties have been established at Leongatha and at Rutherglen. The seed of some of our best native grasses, such as Wallaby grass and Kangaroo grass, have been saved, and it may be possible by a process of selection to improve them. Then the United States Department of Agriculture has a Division devoted solely to investigation in grasses and forage plants, and they have kindly supplied a large number from different portions of that great continent in the hope that some of them may supply a want with us.

Inoculation with Nitrogen Bacteria.

I now wish to draw your attention to an important discovery which has recently been made, and like so many other investigations pursued in the laboratory, without at first being appreciated, is being turned to practical account for the benefit of the producer. On the roots of leguminous plants grown under proper conditions, such as peas and beans, clovers, lucerne, and our native wattles, there are always to be seen little nodules or tubercles in greater or less quantity, and it is now known that these are formed by the remarkable micro-organisms which we call bacteria. It may seem strange at first sight that what appears to be a diseased condition of the plant should prove of benefit in any way, but as is well-known, there are useful as well as injurious bacteria, and in this instance they form a sort of co-operative concern, in which both partners are benefited. These bacteria which produce the swellings have the wonderful property of fixing the free nitrogen of the air and thus enabling the plant to draw upon the atmosphere for its supplies of nitrogen. Only plants belonging to the pea and bean family have this power, as far as at present known, and it would seem that each variety of plant has its own particular bacterial form.

Cultures have been made of these organisms, and they can be used to inoculate either the soil or the seed, wherever the soil is too poor to grow legumes or for some reason or another the tubercles are not produced on the roots of the plants.

The United States Department of Agriculture, recognising the practical importance of providing a supply of this inoculating material in a handy form, have hit upon the happy expedient of using an absorbent such as cotton-wool for soaking up these nitrogen-fixing bacteria and then by allowing them to become dry they can be sent to any part of the world and still retain their active properties. They are done up in neat packages and enclosed in tinfoil, about 4 ins. by 2 ins. in size, each of which contains sufficient to inoculate an acre of

land. It is only necessary to place the cotton-wool containing the organisms in water, and by the addition of nutrient salts also provided, after standing for about 48 hours the solution is ready for use. Several of these packages have been received and are now being tested on comparatively poor land at Mordialloc, near Melbourne.

The growth of leguminous plants is a cheap means of supplying the soil with nitrogen and humus, and is particularly valuable in orchards and vineyards. The soils of some of our northern districts do not give satisfactory results with peas, generally recognised as the best all-round green manure plant, so the sour clover (*Melilotus indica*) was imported by this Branch from Arizona, U.S.A., where it succeeds remarkably well and takes first-place as a winter-growing green manure for orchard purposes. Tests at Dookie in the North-East and at Ardmona in the Goulburn Valley have so far yielded promising results. This year, near Melbourne, seed sown early in April had in two months' time furnished a thick growth nearly eighteen inches high, and is quite unaffected by recent heavy frosts.

Diseases of Plants.

After this rapid survey of experimental work, which has for its object the increase of production, the improvement of quality and a greater choice of fodder-plants for dairying purposes, I now come to the special subject of this address, the Diseases of Cereals, for while new varieties of plants are being tried and new fodder-plants introduced, attention must always be paid to that character which enhances their value and is also a test of their suitability, and that is freedom from disease. The subject of disease, whether in plants or animals, is not an attractive one, and is generally considered by the average farmer as something beyond his control, but I hope to show you that some of the worst diseases to which plants are heir are amenable to treatment, when the nature of the disease is properly understood. In this genial climate of ours, with its quickening influence on all kinds of growth, and the absence of the snow-blanket of Canada or the frosts of winter to compel enforced rest in vegetation, there lurks the danger from various pests.

There are few, if any, crops grown on a commercial scale which are not subject to various ailments, which considerably reduce the yield, but there is this compensating advantage that it has compelled us either to produce varieties which resist the disease or to investigate and study the cause of it, so that we may be able to counteract its effects.

I am happy to say that by well-directed effort in the field and the application of scientific methods in the laboratory we are able, generally speaking, to minimize, if not actually to prevent, the injurious effects of many of these diseases.

The Diseases of Plants have only been seriously studied within the last thirty years, and it is not to be wondered at that there are some which baffle both the so-called practical man and the scientist,

just as cancer and consumption do the doctors, but still a good beginning has been made. Our American cousins have taken the lead in this matter, and as a practical people, are as energetic in stamping out disease as they are in finding new markets for their produce.

Rust in Wheat.

Time would fail me, and it would weary you, to dwell upon the numerous diseases which affect our cultivated crops, so I have chosen for illustration two of the most important to the farmer, because of the serious losses due to them, and in fact the depreciation of the yield in the entire Commonwealth. It is a trite but true saying "That it is not what a man makes but what he saves that constitutes profit," and while every effort should be made to increase the quantity and the quality of our produce, it is also necessary to guard against avoidable losses. The loss from rust in wheat alone it is not easy to calculate, but in the very rusty year of 1889 it was estimated, on fairly reliable data, that it cost Australia £2,000,000. In a small way it can also be reckoned when we compare the yields of two varieties growing alongside of each other, the one rust-liable, the other rust-resistant. During the past season, Queen's Jubilee and Rerraf were grown in the Swan Hill district. The one which was very rusty yielded three bags to the acre, and the other, which was clean, yielded six bags, and although some allowance may require to be made for the difference of yield due to the variety, still the loss caused by rust was enormous.

The total wheat crop of the Commonwealth was last year not far short of 80,000,000 bushels, which at 3s. a bushel gives £12,000,000 as the value of the crop. Of this 28,356,082 bushels is the estimated yield for Victoria according to the preliminary returns issued by the Government Statist, valued at about £4,250,000.

Although the rust has been known from remote antiquity, and the ancient Romans offered up sacrifices to protect their wheat from mildew on 25th April of each year, still its true nature was not understood until the latter half of the eighteenth century.

As late as 1733, Jethro Tull, writing about it in his "Horse-hoeing Husbandry," attributes it to the attacks of small insects "brought, some think, by the east wind, which feed upon the wheat, leaving their excreta as black spots upon the straw, as is shown by the microscope." It was only in 1767 that its true nature as a fungus was determined, and in 1797 it received the name which it still bears of *Puccinia graminis.*

The rust then is a fungus, and has much in common with the wheat on which it grows. Both are plants, living and growing, feeding and multiplying, decaying and dying. The one produces a seed which germinates or sprouts under suitable conditions and grows into a fresh wheat-plant. The other has also seed-like bodies or spores, so conspicuous on the leaves and stem of the wheat, and these germinate and grow into new plants. But the main difference between

them, apart from size and structure, is that the wheat-plant obtains its nourishment from the soil on which it grows and the air which surrounds it, while the other obtains it from the living plant, the wheat. In other words it is a parasite which lives within the wheat-plant and exists at its expense. We know exactly how the rust-spores or minute seed-like bodies germinate and enter the plant by means of little threads or tubes, how these tubes grow and branch inside the plant and drain the tissues of their contents, until they are ready again to produce their spores at the surface. All this round from spore to spore may take place during eight days, so you can understand why and how the rust spreads so rapidly.

All the power for mischief lies in these spores, and if we could only destroy them there would be no rust. In the case of the smut spores, which are on the seed, we can destroy them or prevent them gaining an entrance by steeping the seed in bluestone or formalin, but we know from sad experience that this method does not apply to the rust. The spores are so small and so numerous that they are readily wafted about, and you may have some conception of this when I tell you that it takes about 900 of them end to end to cover an inch.

How is the rust spread and continued from season to season is a most important question, for if we could find out where and under what conditions the rust is lying dormant from the time the crop is reaped till it is sown again, then we might be able to destroy it at this stage and prevent its reappearance.

Although the question may thus be simply stated it is by no means easy to answer.

1. For a long time there was a suspicion in the minds of many practical farmers in older countries that the barberry bush had something to do with its spread, and so firmly was this believed in that the State of Massachusetts passed an Act as early as 1760, compelling the inhabitants to extirpate barberry bushes. And curiously enough it was afterwards scientifically proved that there was a connection between the fungus appearing on the barberry bush and the rust on the wheat, so that it was thought by many that we had simply to get rid of barberry bushes in order to get rid of the rust.

The black form of the rust which often appears late in the season is the stage concerned in the production of barberry rust. The spores undergo a period of rest and then germinate, and if the secondary spores that are formed alight on the barberry leaves they may give rise to another stage of the fungus. Although barberry bushes have been imported into Australia and the black rust strewn all around them, yet no infection of any kind has hitherto taken place.

But it is well known that here in Australia, where barberry bushes are not native and are comparatively unknown, the rust is particularly bad, so that there must be other causes to account for the prevalence of rust.

2. The spores which are produced in such immense numbers may serve to carry it on from season to season. They are light and easily carried by the wind, and it has been shown that they exist in the air as well as on the ground. It is quite common in some seasons for one's clothes to be quite red with the spores in passing through a field of wheat, and at threshing time the air is filled with them. In colder countries than ours, these red spores are supposed to lose their germinating power during the winter but with us it is retained till next season. It is very common to find spores entangled in the bearded tip or "brush" of the grain, and these would form a starting point for the rust.

3. This rust appears on about 20 grasses in Australia, and it is generally considered that they may serve to harbour it after the wheat is reaped, but it is not always certain that the spores would infect the wheat. It has been shown, however, experimentally that some, such as the barley grass (*Hordeum murinum*), can do so, and it is good farming practice to keep down such weeds as much as possible.

Self-sown wheat is regarded as another means whereby the rust may be continued throughout the year, so that it is advisable to feed it down with sheep.

4. There is another possible way in which the rust may be carried over from one harvest to another, and that is by means of the seed in which it may be hereditary. This view has been prominently brought forward by one who has devoted considerable attention to the study of rusts in Sweden, viz., Professor Eriksson. He considers that while infection by spores does occur, the primary infection comes from within from an internal germ of disease inherited from the parent plant and latent in the seed. He has not yet succeeded in giving scientific proof of his theory, but he considers that this view explains the origin of outbreaks better than any other.

It used to be taken for granted that the rust appearing on wheat, oats, and barley was interchangeable and that it could readily pass from one to the other. But infection experiments have shown that this is not the case, that the rust on each of these three different species of cereals seems to have acquired a special liking for a particular species and now they confine themselves to their own choice. Only in the case of wheat-rust it is found that its choice is not yet so definitely fixed as the others and that its spores can in rare instances impart the disease to oats and barley. But between the two latter there is a distinct barrier and the spores from the oats will neither infect wheat nor barley, nor will the spores from the barley infect wheat or oats. It follows from this that adjacent fields of these crops will not affect or be affected by each other, so far as this rust is concerned. This fact had already been noticed by observant farmers, for one wrote to me as follows:—"I have never found rust to spread from one field to another, as two years ago I had 60 acres of oats rusty, while 50 acres of wheat adjoining were free, the oats receiving heavy rain while in blossom, while the wheat

received the moisture when required—just before it burst into ear." It is of course possible that in this instance the wheat was a rust-resistant one, but the simpler explanation is that the rust did not pass from one to the other.

The all-important question still remains to be answered, how to prevent or mitigate the effects of the rust? As the result of numerous field experiments continuously carried on for over twelve years with hundreds of varieties of wheat from all parts of the world, it has been proved that no wheat is absolutely rust-proof, that is to say, there is no wheat known which can be grown under conditions favourable to the rust and yet remain entirely free from it.

But the same experiments have shown that among a number of varieties grown in a particular district, some will resist the rust more than others, are able by their constitution or by their vigour of growth or thickness of their cuticle, to resist the inroads of the rust sufficiently to prevent it from seriously injuring the grain or perceptibly reducing the yield, and such wheats are known as rust-resisting wheats.

I am in the fortunate position to-day of being able to announce that we have one such wheat known as Rerraf, which has been grown in various parts of Victoria alongside of other wheats which have been badly rusted and it has been able to withstand the rust. In the *Journal* for March, 1904, there is a full account of this wheat given, based on reports received from farmers themselves, so that it is not necessary to say anything further here, but it will be instructive to recall the history of this wheat, so that some among my audience may possibly succeed in producing another. It was originally a "sport" obtained from Blount's Lambrigg by Mr. Farrer, Wheat Experimentalist of New South Wales, and sent to me among the wheats which he annually supplies for trial. Twenty grains of it were first sown in the Single Seed Plots at Port Fairy, this locality being chosen for testing rust-resistance, as the climate there is particularly favourable to rust. After each plant was carefully examined as to its vigour of growth and freedom from disease, the best ears were selected from the best plants, and in 1900, $1\frac{1}{4}$ acres were planted, which yielded at the rate of $31\frac{1}{3}$ bushels per acre. In 1901 it yielded 40 bushels per acre, and in 1902 it reached 48 bushels per acre. This was an exceptionally good yield, and although the land did not get any manure direct, the crop followed mangels which had been well manured.

But the mere selection of seed from rust-resistant plants will not ensure the continuance of this quality, for there is a tendency after some years to deteriorate, owing to the continual in and in breeding which occurs in nature. Even with crossbred plants the stock requires to be regenerated in order to maintain the original standard. This work of crossing and breeding rust-resistant wheats has for a number of years been carried on with great success by Mr. Farrer for the whole of the States, and he is not only improving the wheats but at the same time adapting them to the peculiar conditions which prevail in Australia.

3-colour process. R. S. Brain, Govt. Printer.

EARS OF RERRAF WHEAT.

3-colour process. R. S. Brain, Govt. Printer.

EARS OF QUEEN'S JUBILEE WHEAT.

It is well known to many of you what good results have been obtained by the scientific breeding of stock, but it is perhaps not so well known what can be done by mating different varieties of wheat.

The flowers of wheat are fertilized by their own pollen while they are still closed, and it is questionable if crossing ever takes place under natural conditions. This process of continuous self-fertilization produces offspring which repeat the characters of the parent in almost every detail, and striking variations which form the starting point for selection to work upon are very rare. But it is well known that crossing tends to produce variability, and by means of artificial crossing these variations are produced.

The principle of the process is comparatively simple. When two varieties are chosen for a cross, the unfertilized flowers of one parent are carefully castrated and the pollen or male element is taken from the other and used to fertilize it. The seeds produced in this way are sown by themselves, and the produce of the first generation is again sown separately. There is a considerable amount of variation in this second generation from the blending of the characters of the two parents, and such plants are selected for seed as show the characteristics it is desired to perpetuate. The third generation is again treated similarly, and the process is continued until a race is developed which possesses the characters aimed at in a high degree. The "fixing" or permanently establishing these characters takes several years, some coming true after three or four years, while others continue to vary for a number of years. The great point gained by crossing is that a relatively permanent race has been formed, and the seed sown from it will reproduce the parent type.

A very promising rust resisting cross named Bobs was received from Mr. Farrer last season, and it is being tried on a large scale this season.

The bearing of all this on the prevention of rust is evident. By creating a race of wheats thoroughly suited to our conditions, which in addition to other desirable qualities have the property of rust resistance, lies the key to the solution of the rust problem. And this opinion is borne out in a letter received some years ago from the late Sir J. B. Lawes, the distinguished founder of the Rothamsted Experimental Farm, which I have had the pleasure of visiting on more than one occasion in his life-time. He writes:—"I have no doubt that if I grew wheats which had previously been grown in a hotter and drier climate than that of England, I should have the crop destroyed by rust. I have no faith in specifics. You must try and obtain wheats which will grow well in your climate. It will of course take some years of experiment to obtain what you require, but I feel sure that you are more likely to succeed if you direct your attention to obtaining a rust resisting wheat than by trying specifics or by manures."

Take-all.

The one-time mysterious disease known as Take-all has now been proved by the investigations of this Branch to be due to a fungus,

	Fallow
1	28 lbs. Sulphate of Iron
	Fallow
2	28 lbs. Sulphate of Copper
	Fallow
3	28 lbs Potassium Sulphide
	Fallow
4	Check
	Fallow
5	Thomas Phosphate
	Fallow
6	56 lbs. Ordinary Superphosphate
	Fallow
7	56 lbs. Sulphate of Ammonia
	Fallow
8	Check
	Fallow
9	100 lbs Ground Quicklime and 50 lbs Sulphur
	Fallow
10	No Treatment.
	Fallow
11	No Treatment
	Fallow
12	Barley without Treatment

Oats in 1904

(Wheat in 1905)

PATCH OF STONY GROUND NOT SOWN.

PLAN OF TAKE-ALL EXPERIMENTAL FIELD AT GOORNONG.

The quantities of manures given are per acre.

and its ravages are so wide-spread, especially in the northern areas, as to seriously affect the yield. From its generally occurring in patches it is difficult to estimate the total loss, but in South Australia, where it is particularly bad (and has been known since 1852, though its cause undiscovered), it is said in some respects to be more dreaded than rust. In the Report of a South Australian Commission appointed to enquire into it in 1868, it is stated that "Rust cannot commit wholesale destruction, unless in connection with a description of weather such as we rarely have in this Colony, but take-all appears altogether independently of the weather, and as its ravages are irrespective of climatic influences, so are its movements inexplicable by reference to locality or soil. It is, like last season's rust, to be found everywhere, and the richest soils often suffer the most."

The discovery of the true cause enables us to attack the disease with some hope of success, and the field experiments being carried out this season are shown in the accompanying plan.

Goornong was chosen for these experiments, because it was possible to secure there a block of 9 acres which was very badly affected last year, and the soil as a consequence must be well saturated with the spores of the fungus.

The plot consists of 9 acres, and is divided into three portions. The first portion was sown with wheat to which various manures and chemicals were applied. The second was sown with oats, because the take-all fungus does not attack this crop, and it will be sown with wheat the following season in order to see how far the fungus has been starved out by being deprived of its natural food, the wheat plant. The third portion is laid out in early fallow, because it is the experience of many farmers that early fallowed land with plenty of rain escapes the take-all, and this may be due to the fact that the action of the sun and the moisture favour the germination of the spores of the fungus, which having no plant to prey upon will naturally soon perish. As a matter of convenience the fallow is laid out in strips, alternating with those of wheat. It is believed that the action of some of the chemicals which have been applied to the soil will have the effect of destroying the spores, and should patches of take-all show after all in some of the plots, powdered bluestone and powdered sulphate of iron will be respectively applied in order to see how far they act as a check. Viewing the matter from the farmer's standpoint, special attention is being devoted to finding some inexpensive substance which can be applied with the drill at time of sowing. The experiments will be conducted for three years, and should throw some light on the best methods of treatment. Burning the stubble has also been recommended, and that is also being tried.

Meanwhile, on land subject to take-all, continuous wheat growing should not be practised, but a crop or two of oats should be grown, to be followed by wheat, since it is fairly well established that wheat after oats does not suffer, at least severely, from the fungus.

It may prove both interesting and instructive to follow the steps whereby this take-all disease was proved conclusively to be caused by a definite fungus, especially since it had hitherto baffled both practical farmers and scientists in Australia. Every conceivable cause was assigned for it. It was said to be due to exhaustion of the soil and that the application of manures would remedy it; that it was owing to too much salt in the soil, to want of drainage, to the presence of insects or threadworms, and even certain weeds have been blamed for it. It was also said to be in the seed and some common fungi were believed to produce it, but there was no convincing proof offered that any of these numerous causes were capable of producing the disease.

In December, 1900, samples of white-heads of wheat were sent to me from South Australia, and the fungus which was afterwards found to be the cause of both take-all and white-heads was determined and named. There was no proof, however, that the fungus actually caused the disease, since it might have attacked the plant after it had been weakened and rendered susceptible from some other cause. Then in November of last year the disease was particularly bad, and the personal inspection of numerous take-all patches revealed in every instance the presence of the self-same fungus, the dying or dead plants being more or less blackened at the butt. It was observed at the same time that the disease known as white-heads or dead-heads was due to the same fungus, only the plants had sufficient vigour of growth to produce the ear but not the grain, or at most a few small shrivelled grains.

Still it was not absolutely certain that the fungus was a cause and not a consequence of the diseased condition, until the fungus was applied to healthy wheat and the take-all produced by it. This final court of appeal settled the question, for on growing wheat in pots to which take-all stubble had been added, the plants became infected by the disease, and in 52 days after sowing produced spores capable of infecting fresh plants. The infected plants were dead or dying, while the plants in the check pots, in which no stubble was put, were healthy and green.

In dealing now with take-all and its remedies, one is no longer working in the dark but has a definite object in view, either to destroy the fungus by direct attack with the application of various manures and chemicals, or to starve it into submission by depriving it of its ordinary nourishment. It was also found that the fungus can grow upon the spear-grass (*Bromus sterilis*), and since it is highly probable that the wheat may be infected from this source, the keeping down of all such weeds is an important part of the work of overcoming the disease. Experiments are being made to ascertain with certainty whether wheat can be infected by the fungus taken from spear-grass.

There is just one final suggestion to make, and that is, there may be some varieties of wheat more resistant to this disease than others, and farmers should select seed from any special plants which seem to have this property.

Conclusion.

I have endeavoured in the time at my disposal to treat of two of the most serious diseases of wheat, and at the same time to point out the most effective measures to be taken in overcoming them as far as possible at present. You cannot fail to have been struck with the fact that the modern farmer, if he is to compete in the markets of the world, must not only attend to sowing with the best seed, applying the proper manures, and cultivating in the most approved fashion, but he must also guard against "the pestilence that walketh in darkness" and the rust that may ruin all his labour. "Give us the rain at the right time and we will grow the crops" I often hear farmers say, but what of the rust, the smut and take-all. These and other diseases require to be studied if we are effectually to control them, and I have failed in my object if I have not convinced you that it is only by the combination of scientific knowledge with practical skill that the best results are to be attained. It is not contended that the farmer should be a scientist, that he should be trained in the use of the microscope and in all the details of chemistry, bacteriology, and botany, but he should know the results of such investigations as far as they apply to his own particular industry. This is technical knowledge, and the Short Courses of Instruction for Farmers and Farmers' Sons inaugurated by the Director of Agriculture, in my opinion, form the connecting link between Science on the one hand and Practice on the other. I regard it as one of the great functions of an Agricultural Department to help the producer with knowledge, to place at his disposal the best and most recent scientific and practical experience, to enable him to make the most of his opportunities. Much of my own work has to be done "behind the scenes," and there is often too much impatience for immediate practical applications, but sooner or later it comes out into the open, and by means of field experiments conducted in co-operation with the best farmers, the practical results are rendered available to all.

There is one branch of his business which the farmer is apt to overlook, and that is the nature and peculiarities of the plants which he cultivates. The whole duty of the agriculturist does not lie merely in studying the soil and the manures necessary for its fertility, but he should also devote some of his attention to the plants themselves, how they behave and adapt themselves to the climate, how some are better fitted than others to withstand drought or cold, how some are more prolific than others, and so on.

It is only by this kind of accurate knowledge, or science, as it is called, that the producer can hope now-a-days to make farming pay, and the motto of the modern agriculturist should be that of the Royal Agricultural Society of England—"Practice with Science."

THE WATER SUPPLY AND DRAINAGE OF BUTTER FACTORIES.

By T. Cherry, M.D.

Filtering the Water.

The importance of a pure water supply at every stage in the preparation of butter is well known. In order that food products of all kinds may keep well it is essential that as little dirt as possible should be mixed with them. Care needs to be exercised at every stage of the process from the beginning to the end, for neglect at any point is fatal to the whole result. Pure water is therefore a necessity. The smaller the amount of organic matter and the fewer the micro-organisms the better. Water may be purified either by gravity filtration, by pressure filters, or by heat. Each method has its special advantages; but taking the average conditions and requirements of our factories I think the best plan is the old-fashioned method of sand filtration. The filter bed consists of approximately one foot of gravel at the bottom, then two feet of sand, the finest being placed on the top. The finer and sharper it is the better. There is from 12 to 18 inches of water on top of the sand, so that the pressure is very slight. The average rate of filtration is found to be about 50 gallons per square foot of surface in 24 hours. Nearly all the filtered water supplied to towns in all parts of the world is subjected to this method. In London, where over 160 million gallons of river water are filtered daily, this method is invariably used. There is no question, therefore, of its efficiency. The remarkable thing about it is that the number of micro-organisms per cubic centimeter is reduced to less than 100, whatever may have been the number to begin with. The number in the unfiltered Thames water last October and November averaged about 17,000 per c.c. Filtration reduced them to 60. The water from the Lea contained 540 before and 26 after filtration. To give local comparisons, the unfiltered Thames water is about the same as the Yarra at Princes Bridge; the Lea is about as pure as the Yarra above Studley Park. The London sand filters cover more than 100 acres. The average amount filtered is from 20 to 70 gallons per square foot of surface per 24 hours. The thickness of sand varies from 1·75 to 4·3 feet.

The construction of these sand filters is very simple. The area is determined by the quantity of water required per day, on the basis before stated. The retaining walls are four or five feet high, and the bottom is graded to slope to the outlet. The walls may be made of brick, concrete, or wood. Good, clean, sharp sand and gravel are all that is required; a number of large pebbles are arranged round the outlet so that the water has free egress. The feed water is run in at

the same rate as the filtering is going on, so that the head of water is always maintained the same. The storage tank should not be any larger than is necessary, as filtered and sterilised water when stored rapidly deteriorate owing to the multiplication of organisms in them which at once begins. This is very marked in the case of sterilised water. The only attention required is to clean off the greenish scum which forms on top whenever the rate of filtration becomes too slow, and to remove all the sand, wash it and replace it again about once a year. The scum makes the rate of filtration slower, but it is an advantage so far as the efficiency of the filter is concerned. After the filter has been re-started the water should not be used for the first 48 hours, but allowed to run to waste, as it takes some time for the filtration to attain its full degree of efficiency.

One of these filters has been in use at the Gormandale factory for the past four years. The sand is simply put into a 400-gallon tank. The water is from a branch of Merriman's Creek, which flows through the swamp. Live stock have free access to it, and from the amount of vegetation in it there was much difficulty in treating it effectively. The number of organisms before filtration, but after sedimentation, varies from 750 to 3,000. The number in the filtered water is usually below 50. In order to test its efficiency, the sand has never been completely removed, but the upper 12 inches has been changed once since it was started. The scum is removed every six months. The water at present contains 116 per cubic centimeter, so that very fair water is supplied with a minimum of attention and supervision. Mr. Huffer tells me that he has had no complaints whatever about the quality of the butter since the filter was constructed. A filter 10 feet square will be large enough to supply the largest factory. In most localities these filters can be constructed very cheaply, they are nearly self-acting from one year's end to the other, and they can be relied upon more implicitly than any other method. Water containing only 20 to 50 organisms per cubic centimeter is as pure as it is practicable to obtain it for manufacturing purposes, and when purification is necessary this method should be carefully considered before deciding the question.

An Efficient Drainage System.

Disposal of the drainage of a factory becomes a somewhat difficult problem on account of the amount of organic matter the water contains. Decomposition therefore readily takes place, and the drains become offensive, especially in hot weather. The organic matter consists of a little buttermilk and fat; the amount is apparently trifling in itself but it becomes a nuisance when allowed to deposit day after day in the same spot. The best system of disposal is that adopted at Cowwarr and Boisdale. The water is simply pumped on a small area of ploughed land, and the spot where the water is applied is changed from day to day. The details of this plan are as follows:—All the drains from the factory are led into a sink (say 2 ft. 6 in. by 2 ft. 6 in. by 2 ft. deep). From this a 1½ in. pipe conveys the water

to the irrigation paddock, which immediately adjoins the factory. One-half acre of land will suffice for 1,200 gallons of water a day on an average throughout the year. In summer this quantity may be more than doubled without difficulty. If the paddock is rectangular in form the pipe is carried across to the further side, a bend is then screwed on, and the pipe continued along the fence to the end. The first day's water is thus discharged at the end of the paddock. Last thing in the afternoon a shovelful of earth is thrown on the small patch of whitish curd and fat which has accumulated at the end of the pipe, and one length of the pipe is unscrewed. Everything is then ready for the next day's drainage, when the operation is repeated. When the whole of the pipes to the bend are successively unscrewed, the bend itself is moved one length back and a fresh line of irrigation begun about 15 feet from the former one. In this way irrigation proceeds backwards and forwards across the whole width of the paddock. The essential points are to run each day's water about 15 feet distant from that of the day before, and to cover up the curd and sludge each evening. The time occupied amounts to not more than five minutes a day. The pipes simply require to be loosely screwed together by hand, a few drops leaking from a joint being of no consequence.

A few practical details may now be noticed. The sink should be provided with a strainer to prevent the pump from stopping work, and if the steam is laid on a handful of soda may be thrown into it and the whole thing scalded out two or three times a week. On level ground a pump or ejector is required, but in many factories the same scheme may be worked by gravitation. The best arrangement is to have the sink fairly near to the skim milk tanks. The space on which the carts stand, and that under these tanks, is graded and paved to a small pit in the centre, which is trapped and connected with the sink by underground glazed earthenware pipes. The whole place may then be hosed down each day as soon as the tanks are empty. The irrigation paddock requires to be ploughed up or scarified twice a year, and if suitable crops are grown a very valuable object lesson may be given to the suppliers. I would suggest that half the paddock be laid down to lucerne, and two crops a year be grown on the other half. A mixture of oats and tares for the winter crop and maize or sorghum for the summer crop will suit most districts, but the selection of the crops may be left to the judgment of the manager. I mention these because they are the most important ones for the dairying industry generally. The crops should all be sown in drills three feet apart, so as to allow room for the irrigation to go on between them. An open drain 12 to 18 inches deep should be made all round the paddock, so as to prevent water-logging in the winter.

In some situations the pipes may be made to radiate from the point where they enter the paddock. A double bend is used at this point, and the line of pipes shifted each time so as to successively occupy positions corresponding to the ribs of a fan. If possible, however, the rectangular system first described is preferable.

Another method suggested is that of the septic tank and coke breeze filter bed. This method, however, is more expensive as far as the initial cost is concerned, and takes about the same amount of attention to keep it in good working order. It is not necessary with fluids containing as little solid matter as is found in the drainage from the butter or cheese factory. If care is taken to use the shovelful of dry earth every evening no offence whatever will arise even in the hottest weather, and I feel sure that a factory could dispose of its own drainage on a half-acre in the middle of a large town.

A FEW LESSONS FROM THE PAST BUTTER SEASON.*

By R. Crowe.

Perhaps since the inception of the butter export trade no season has been more prolific and varied in experience than the one just closed. Each feature of it is suggestive, and a study of them all will emphasise the necessity of avoiding and remedying certain weak methods.

Fortunately the season for grass was prolonged well into the summer, and the output has in consequence far exceeded the most sanguine expectations formed this time last year. Notwithstanding the fact that many of the dairy cows missed calving, and others started in very low condition, already over 14,000 tons of butter have been exported and by the end of June, when the financial year closes, the value will approximate £1,500,000.

Old Stored Butter.

These exports included 1,000 tons carried over from the previous season, and herein is to be found the first experience of the season worthy of consideration. There was some stored butter on hand at the opening of the season, nearly all of which was purchased by speculators, and in not a few instances by grocers all over the country in anticipation of a shortage during the winter to "provide for a rainy day."

Contrary to expectations it did rain, but in a manner not bargained for. As the supply of fresh butter therefore was ample to serve current local requirements right through the year, holders had to ship, some of course selling here at a loss, though in any case the stock had to be exported. This butter cost in some instances 11d. per lb., the storage amounted to nearly a penny more, and with freight and charges added, it should realise about 125s. per cwt. in London to make both ends meet. It actually sold at about 80s. and 90s. per cwt. Both investors and speculators lost in the aggregate at least £35,000 on the transaction, for although the producers in the first instance were paid more than the current value of the article, ultimately the business proved a bad one for them in particular and the dairying industry in general. It was stored butter, and butter, unlike whisky or wine, does not improve with age. In the first place it was not made to keep for any length of time, as it was manufactured, not for an export trade, but for the local market, and in certain instances its treatment was not calculated to produce good results. Some of it changed hands in the middle of the storing period and was taken from one freezing works to another. All this tended to depreciate the quality of the stock of stored butter, and, preceding the season on the London market as it did, meant a bad advertisement for the industry. Everything that was possible to counteract that

* A Paper read at the Annual Conference of the Australian Butter and Cheese Factories Managers' Association, May, 1904.

bad influence was done; circulars were sent to all the butter factories and exporters advising them to brand their boxes "New Season's Butter," a recommendation which was adopted. It was rumored during the season that some of the old butter was similarly branded after reaching London, but this has not yet been verified. Those factories whose stored brands had a deservedly high reputation were peculiarly liable to injury, for, as before stated, the butter was not prepared for export in the usual way, and having been kept in store for a long time before shipment must have interfered with the sale of those brands later on in the season. Butter factories were circularised by the Department on this subject, both before the season commenced and on numbers of previous occasions. It was pointed out that the butter might be sold conditionally as not made for export, but this was hardly practicable, for when a person buys butter or other goods it is his property and may be sold again by such purchaser or despatched to London or elsewhere as he pleases. There is no authority or law to prevent this being done, nor is there likely to be, so it was recommended that all factories should have a distinct brand for the local market and another for the export trade. The latter, of course, would be reserved for direct export business by the factory itself. Vested interests stand in the way in the shape of a recognised reputable brand of long standing, but although some sacrifice will have to be made to overcome the difficulty, this is the true remedy.

It is improbable that butter speculators will forget their recent loss of over £35,000, and it is not likely that the experience will crop up again for many years to come. In the meantime, however, a deterrent might be applied in the shape of a brand such as "Stored Butter" going on all lots in store, say over three months before shipment. Fresh legislation is slow and advisedly so. It is not easy to get a law or regulation passed unless the occasion for it arises in a pronounced manner.

When the Exported Products' Act, 1898, was passed, it was provided that, on the despatch of butter to a cool store for shipment, notice should be sent to the officer in charge of the cool store. A cul-de-sac was thus reached when the butter was sent through outside cool stores, and the butter might be shipped with impunity without the knowledge of the Department. In fact a striking case did actually occur early in the season, and that experience brought about the adoption of a regulation making it obligatory on all shippers to give due notice to the officer in charge of the Government Cool Stores.

Now the position is clear on this point, and an expression of opinion is desirable on the method of dealing with stored butters prior to shipment, since it is clear the practice is detrimental to the dairying industry of Victoria.

Re-Opening Business Connections.

A great handicap was experienced this last season on account of Victorian butter having been practically off the London market the previous year. To be unrepresented on the home markets for seven

months each year is a serious drawback, and for this intermittent supply the State has to pay the full penalty in the shape of lower prices than are paid for the product of countries shipping regularly every week in the year. But when it comes about that *no* butter at all is sent to our oversea customers for nineteen months at a stretch, the disadvantage is incalculable. Regular winter buyers, being obliged in the season 1902-3 to seek fresh fields for a supply, bought New Zealand or Argentine butter, and naturally became to some extent alienated from Australia. In consequence a sacrifice had to be made to win back the connection. The remedy is obvious, the growth of fodders for the dairy herds, and the preservation of surplus feed when plentiful to provide for times of drought and scarcity, and the conservation and proper utilization of water. The lesson experienced the season before last has not been in vain. Commendable efforts are being made in every district, and much of last season's surplus growth has been safely put by for future use. However, there still remains much more to be done in this direction. One would be safe in saying that for every one who may be doing all that is necessary, there are four others who are doing nothing whatever.

At last it seems that the making of ensilage is going to be extensively adopted by dairymen. In nearly every district new silos were built and filled during the season, and the practice is bound to spread. Much credit is due to Dr. Cherry for his efforts in this direction. In travelling amongst dairymen the increasing interest that is taken in the cultivation of fodders is strikingly noticeable. It, however, seems to me that the number who intelligently discuss the relative feeding values of the various crops is far greater than those who make no practical effort in the direction of growing them. The most appropriate advice to these people would be "wire in and grow anything that is good, luscious cattle food—it does not matter what—maize, sorghum, beet, anything that will thrive and give an abundant yield, heaps of it, stacks of it, don't be afraid of having too much, always have some on hand and some more coming on; and so when you get into the habit of growing fodder, experiments can be made to see which kind gives the best results."

Dr Howell's field experiments are very instructive and suggestive, but the results will be valuable only in proportion to the extent to which they are taken up by dairymen. Now I would like every factory manager to make up his mind to influence as many of his suppliers as possible to adopt the practice of growing something for his dairy cattle when feed is scarce. The loss incurred by allowing dairy cows to starve cannot be estimated, for there is a loss at the time in shortage of returns, there is another loss in progeny, and subsequently there is a great and continuing loss through the impairment of the health of the cattle. If our dairy cows are provided for properly in the future there is no likelihood of a repetition of last season's experience. Our exporters of butter will not have to disappoint those customers in England who look forward to getting supplies from Australia at regular seasons of the year.

Shipping Temperatures of Butter.

By no means the least serious trouble encountered last year was the unsatisfactory temperature at which some of the butter was delivered in London. Instances occurred when the butter was as high as 35 degrees Fahr. when landed. All through the early part of the season complaints were numerous regarding "fishiness" in butter. It is a significant fact that when lower temperatures became the order of the day later on, fishiness was not heard of at all. New Zealand butter, which is always carried at a much lower temperature, under 10 degrees Fahr., does not turn out fishy in flavour. Of course only a few brands from here develop the fault, and some people naturally conclude that it is inherent in the butter itself. So it is, but it is not propagated until high and variable temperatures are continued for some time. The point gained with such butters by keeping and carrying at low temperatures is that it finds its way under ordinary conditions into consumption before the trimethylamine flavour develops sufficiently to be apparent. The organisms which produce this result in butter are associated with dirt, and in every case the particular difficulty can be avoided by keeping the dairies, utensils, and factories clean. I have known of many instances where the fault disappeared with the adoption of cleaner methods throughout. Although in passing I insist upon cleanliness, it in no way obviates the necessity for carrying butter at low temperatures. Experiments carried out in all butter producing countries in the world in recent years proved in every case that the lower the temperature at which butter is maintained the better chance it will have to keep its quality. In fact some authorities are quoting zero as the best temperature. All that has been suggested by me so far is a maximum temperature of 20 degrees Fahr.

Fancy a contract in the year 1904 at £7 per ton freight "To endeavour to keep the temperature of the holds below 35 degrees." It is simply ridiculous. It was such high and unsatisfactory temperatures that prompted the Department to try the experiment of shipping tell-tale thermometers inside boxes of butter. The first set to arrive was in a boat which reached London some weeks ago. The temperature and condition of the butter are cabled as unsatisfactory, but details are not yet to hand. Since then two dozen tell-tale thermometers have been shipped in butter and fruit, and it is expected that specially designed and improved instruments capable of recording the temperature inside a box of butter every hour during the voyage will be ready for use before the opening of next season. It would be far better if the shipping companies agreed to take self-registering apparatus under seal, as everything would then be open and fair. The danger of exposing trade secrets can be no longer deemed a sufficient excuse for withholding the privilege, as is evidenced in the fruit carrying business.

The remedy for this most serious matter of the carrying temperatures of butter is that the factory managers, being so deeply interested

in the quality and reputation of their butter, should strongly urge their Boards of Directors when making the next contract for the carriage of butter to London, to insist on a guarantee of a temperature below 30 degrees Fahr. during the voyage and the carrying of self-registering thermometers, such instruments to be placed in the chambers in approved positions and sealed prior to the sailing of the steamers from Melbourne.

Faults in Manufacture.

Certain factory managers are getting very careless; perhaps the fact that there was no London market the year before this had something to do with it. One would naturally think that when a man brought his output up to a certain standard he could keep it there. Some managers will notice from my reports during the season more than due reference to "mottle," "excess of moisture," and faults of this nature. Why there should be any mottled butter nowadays is difficult to understand, and possibly it is due to the employment of new buttermakers, but that ought not to be, for a manager should insist on a method being religiously practised that would obviate the complaint altogether. In every case that came under my notice it is due to not bringing the salt into contact with all the butter when working.

Would-be authorities are afraid of working their butter too much when it is soft. Such buttermen should try this little experiment on their own account some day, the sooner the better:—Work soft butter a little as usual, next a duplicate lot to an extent that will thoroughly mix in the salt—never mind the texture—then put the two into the cool room for the second working. When placing on the worker the second time, or when finally packed, closely observe which lot has the better texture. The latter will be found to be the better of the two. In certain factories' reports the remark "Excessive Moisture" appears sometimes. This always means, unless a report on analysis accompanies the usual advice, that there is too much appearing on the trier. When the butter is drawn the water runs off. You know it does not always follow that the percentage is unusually high when the moisture shows in this way, but whether the water contents are much above normal or not, it is always a bad sign and discounts the selling value of the butter. It is the indication that the buyer, wholesale or retail, goes by when purchasing.

I am sorry to note that the average moisture contained in butter is on the increase. The average of all samples analysed last season comes out exactly at 13 per cent. Out of 70 samples analysed,

2	or	2·85	per cent.	showed	between	9	and	10 per cent.
13	„	18·5	„	„	„	10	„	11 „
5	„	7·14	„	„	„	11	„	12 „
12	„	17·14	„	„	„	12	„	13 „
16	„	22·85	„	„	„	13	„	14 „
11	„	15·71	„	„	„	14	„	15 „
11	„	15·71	„		„	15	„	16 „

By grouping the results of butters of each district it is found that the Western district samples show an average of 12·27, Gippsland 13·62, North-Eastern 12·74, and Northern 12·23.

Managers should endeavour to keep the percentage below 13 per cent., especially when packing for export.

Some years ago the averages were under 12 per cent. You will remember at a former conference I laid considerable emphasis on keeping the moisture contents within reasonable limits, and on that occasion I suggested a range of from 10 to 12. If the results of your deliberation teach some of you to imprison more moisture in your butter than the trade requires, grocers and buyers of butter will recognise that the box which will cut out 55½ lbs. is worth more than one which cuts out at 55 lbs. only, and give a higher price accordingly. If therefore, Victorian butter becomes recognised as containing 1 per cent. more moisture than butter from other countries more careful in this respect, then prices will recede to 1 per cent. below theirs. Those in the industry will then have the grim satisfaction of realising that with every 100 tons of butter exported they go to the expense of putting up, boxing, paying railway freight, and ocean freight, on an extra ton without reaping any corresponding advantage. It is to be hoped in the interests of the dairying industry that this matter will be properly legislated for.

Conclusions.

Many of our good factories secured an average of 98s. per cwt. for the season on the London market. This must be regarded as being exceptionally good and much better than those in the trade bargained for at the opening of the season. It was thought that having been off the market for a year, and with the increased supply from other countries, especially from Siberia, Victorian butter would have a difficulty in securing averages over 94s. to 95s. Of course dairymen and the public generally think that because the prices are lower than those of the three preceding years there is something wrong. It must be remembered, however, that the prices secured the three previous years were phenomenal as regards butter, and if the average of last year, namely 98s. be compared with ten years' average on the London market before that, it will be found that there is no cause whatever for alarm.

The surprising feature in connection with the butter export trade is that in our history of the business the imports to Britain have multiplied 2½ times and yet the prices are maintained at approximately the same level. Considering the adverse circumstances dealt with at length by me I think all will agree that a remarkably good and profitable year has been experienced, and that attention to the lessons set forth will secure much better results in the future.

DRY RED WINES AND THEIR TREATMENT.

By M. d'A. Burney.

Part II.

At the time of first racking, under ordinary circumstances the cellar will contain wines of different grades, characters, colours, etc., owing to the difference in the variety of grape and differences in the soil and situation of the vineyard. The wine maker who aims at producing an export wine should endeavour to produce a wine of a given and standard type. He should be able to show to the buyer an even lot of wines of the one type and character. Owing to the cost of labour it is not always feasible to pick different portions of the vineyard at once, so as to blend the grapes in the fermenting vat, and consequently wines of different types have to be graded and averaged afterwards and blended into the one even export type of the vineyard. This type should be a heavy wine of good colour, dry, but fruity, and if rough and heavily charged with tannin it is no fault at this stage. It must not be sweet, nor must it contain more than a small percentage of fixed acids. More important still, it must not be a thin, hungry wine, lacking body. The wine maker should endeavour to produce this type as soon as possible, beginning at the time of first racking. Having noted the alcoholic strengths of his wines as they are maturing, he will blend his thinnest wines with his heaviest, and so on, so as to produce an even sample. Often a wine containing an excess of sugar when fermented to say 27 per cent. proof spirit will lose that excess if blended with a perfectly dry wine containing 24 per cent. The wine maker must draw samples and attempt to copy his previous vintage as far as possible with the material at his disposal. It is not possible to explain accurately on paper how he is to arrive at this desired result, as much depends upon the knowledge of local conditions and the results of previous experience. In the North-East District of Victoria the wines from the Malbec grape, if picked when they contain up to 14 deg. Beaumé, will almost always ferment out dry, producing a wine containing between 26 per cent. and 27 per cent. proof spirit of good colour and character. Cabernet Sauvignon is sometimes a trifle deficient in colour, but of great flavour and distinct character. Shiraz of fine colour and body does not always ferment out as dry as could be desired. The method to be employed is self evident. The Malbec must be used to reduce the excess of sugar in the Shiraz, and the Cabernet to improve the flavour and character. If, however, a wine of whatever kind of grape contains 1 deg. or 2 deg. Beaumé of unfermented sugar with an alcoholic strength above 26 deg., it must not be put in with the blend, except in small proportions, for fear of having an excess of sweetness that would be detrimental to the type of wine desired. Buyers for the London market like a fruity wine, but it must not be sweet, even though the

tendency now is towards a wine almost sweet. There lies a delicacy of definition that it is hard to do justice to with the pen. It can only roughly be gauged by the saccharometer. No wine in which the saccharometer sinks below the 0 deg. will be too sweet for export, though it may yet be fruity. There must be a sufficient roughness in the wine to precipitate the albuminous matters still in suspension, as well as a safeguard to protect the wine from its deficiency in fixed acids. Here the pressings may be of use. If they are racked after about the first week, and then a few weeks later begin to clear, they can be of value in giving that roughness that is required. It must not be overlooked that the pressings are inferior to the other wine. If they are stringy, stalky, or bitter this must not be confounded with roughness which is simply tannin. It would be better to buy tannin and add it to the wine to supply the deficiency rather than add pressings that are stalky. This stalkiness seldom completely disappears, and often spoils an otherwise palatable wine. To summarise, let the grower discard his thinnest wines and keep them for Clarets, etc., his sweetest wines and fortify them for Port, and his pressings and faulty wines to distil them, and only keep his fullest, roundest and best for the export type. He must aim at a high grade and keep to it, and rather make other use of his wines than render them unsuitable for a market that is capable of extension, provided only the type be always of a class to suit the consumer, and not merely the overflow from an overstocked cellar. It is to the grower's own interest to arrive at uniformity, so as not to have the cream taken by the buyer and the second quality only left upon his hands.

THE CLARIFICATION AND LIMPIDITY OF WHITE WINES.*

By J. Laborde. Translated by M. d'A. Burney.

I.

Limpidity is one of the most important qualities that wines must possess when ready for consumption. It is well known that if this quality is not at its maximum a delicate wine does not give the impression expected of it, and a wine that is not perfectly limpid ought not to be tasted. Perhaps it is even more necessary that a white wine should be perfectly brilliant when tasted than a red wine, because in this case the eye is affected to the same extent as the nose and the palate, while hardly in the same degree with a red wine. The pale golden colour not over accentuated, the brilliance of the wine as clear as crystal, are, for the taster, qualities which favourably impress him for the sensations to follow. Now this much desired brilliance is not always to be obtained without much trouble. It is, on the contrary, one of the chief difficulties in the making of white wines. We will examine the diverse phases of the clarification of these wines, the causes of cloudiness, and the best methods of arriving at complete limpidity.

II.

While red wine is often fairly clear when it is taken from the vat, or clears completely after a few weeks in cask, white wine is often months before losing the milky appearance so well known in young white wines. This cloudiness is due, at first particularly, to the yeasts of the secondary fermentation, which only deposit themselves slowly because they gradually diminish in size and activity as the medium becomes more and more unfavourable to their development. But, after the depositing of the yeasts, the white wine is not yet bright, for it has often for a long time an opalescent cloud due to the presence and physical action of certain albuminous matters in the must. If it is not exactly the same in the case of red wines, it is because of the abundance of tannoid matters, which, in uniting with the albuminous matters, determine their coagulation and precipitation in the lees. In the must of ordinary white wines the quantity of tannin is 10 times less on the average than in red wines, that is to say, that it is in the proportion of a few grains per gallon only while the albuminous matters are always in greater proportion. Now as the coagulation of these matters requires a weight equal to their own of tannin, it is evident why it is incomplete. It seems, therefore, that no traces of tannin should be found in the wine in these circumstances, but that is never the case. Experiments have proved that small quantities of

*J. Laborde, Sub-Director of the Agronomical and Œnological Station of Bordeaux, in the *Revue de Viticulture*, Nos. 525, 526, 528, 529.

tannin may remain in solution in the presence of albuminous matters in artificial liquids of similar composition to that of wine. If these bodies are associated in proper proportions a liquid that contains a small proportion of them remains limpid, but if a little tannin only is associated with a larger proportion of albuminous matters, the liquid has a more or less pronounced opalescent appearance due to a commencement of coagulation of the nitrogenous matters. The precipitation of the excess of pseudo-albuminous matters in solution ends, however, by being produced under the influence of a slow coagulation of which all the causes are as yet not very well known. In this phenomenon, great differences are noticed in accordance with the wines, the districts where they are produced, and the seasons. The observations that we have been able to make hitherto have led us to believe that there are two causes which account for these differences. The first is purely physiological. When different varieties of yeast are cultivated in the same must, which has been sterilized but has still kept its opalescent appearance after the fermentation is completed, great differences in the rapidity of the clarification of the wines are noticed. In this clarification it is not only the more or less rapid deposit of the yeast in suspension that must be considered, but also the loss of the original opalescence of the must. These differences appear then due to the variations in the action of the products secreted by the yeasts from the albuminous matters. There are here probably diastasic actions which it would be interesting to study closely, since they pertain to the selection of the yeast, and moreover this study should have a practical side. The second cause exists in the action of the oxygen of the air, which may be either exclusively chemical or physiological. Pasteur was the first to unveil the effect of aeration on the colouring matter of wines. During the last few years a more intimate knowledge of the mechanism which rules these effects has been obtained by the discovery of oxidasis, and the phenomenon of "casse" (breaking), incontestably allied to the coagulating actions at the same time as oxidation. Young white wines when exposed to the air are the seat of these phenomena, which take a greater or a lesser intensity according to the nature of the wine. The rendering insoluble of a portion of the tannoid matters carries with it the precipitation of other colloid matters, such as the albuminoids, or the soluble combination of tannin and albuminoids becomes insoluble when oxidised as in the following experiment:—

An aqueous solution of cream of tartar at 2 grammes per litre (roughly 4¾ ounces per gallon) is alcoholized to 10 per cent, and to it is added 1 gramme of tannin, and then an equal quantity by weight of albuminous matter in solution, albumen, protein, casein, etc., so as to determine a precipitate in the liquid as in the fining of the wine. After a few hours rest the liquid is filtered, and in the clear liquid resulting the acidity of the cream of tartar is saturated with caustic potash, very slightly in excess of complete saturation. Soon the liquid develops a more or less deep greenish colour though at first quite limpid. Little by little this limpidity diminishes, and

a slight cloud appears which eventually becomes a flaky precipitate which falls to the bottom of the vessel leaving the liquid hardly at all coloured, and perfectly transparent. Under the same conditions the liquid containing tannin without albuminous matter colours but with no precipitation, and we know that this colouration of tannin in an alkaline solution is due to the oxidation which takes place in the above experiment in favour of the oxygen contained in the liquid in solution. On the other hand, the same solution containing albumen without tannin does not precipitate when rendered alkaline. It is, therefore, the combination of both tannin and albumen that was oxidised just now. Besides if, before alkalization, this liquid is boiled so as to get rid of all the oxygen dissolved in it, and it is kept from contact with the air after alkalization it only colours slightly and remains almost limpid. But as soon as the liquid is strongly aerated the cloud appears at once, and the colour deepens. In this experiment the oxidation which has brought about the coagulation of the combination of tannin and albumen has been purely chemical. In the case of wine, the medium is always acid. Oxidation of the oenotannin is produced however, although more slowly as in the following conditions :—

A young white wine is bottled without much care, preferably with tapered corks which do not touch the liquid, and the bottles are left standing for some weeks. In certain of these samples the free surface of the wine, in contact with the air enclosed in the neck of the bottle, will be invaded with *Mycoderma vini* or *aceti*, the activity of which will be sustained by the easy diffusion of the air contained in the bottle, and the outside atmosphere. No account must be taken of these samples. Only those that happen to have been deprived of any germs of disease will be used to observe the phenomena of clarification. After a certain time the opalescence increases, the wine becomes very cloudy, and then a fine precipitation is formed sometimes flaky, and is deposited little by little on the bottom of the bottle, with a pronounced brown colour, while the rest of the wine remains absolutely limpid. The precipitation can then be easily separated, either by decantation or filtration. At this moment other changes are noticeable in the wine, the colour is more yellow, and the wine tastes flat. The wine is slightly "cassé" (broken) which, while being favorable to clarification and consequently to a certain amelioration, has passed the desired aim, and has consequently too much affected the colour and taste. These modifications are naturally of a greater or less intensity according to the quantity of oxidase the wine contains. It is known that wines from perfectly healthy grapes only contain traces brought by the pulp of the grape, while if the grapes are rotten the quantity of oxidase will be increased.

If this influence of the air is to be made use of it must be with care, hence frequent racking into slightly sulphured casks. Sulphurous acid, without completely preventing the action of oxidation and coagulation above referred to, is the most handy and efficacious corrective against over oxidation of a wine.

In addition to the two natural influences which have been considered, there is an artificial action which can now be easily employed to hasten the clarification of white wine, viz., the action of heat applied by pasteurisation. The fact that certain matters are coagulated by heat is well known, and it is even known that the presence of alcohol assists this action. Thus wines heated to a temperature even lower than that usual in pasteurisation become more or less cloudy, according to their age and previous methods of clarification employed.

With complete rest at the end of a more or less lengthy period this cloud becomes more concrete in the form of a light flaky deposit which can only be successfully eliminated by a light fining or filtration.

It is for this reason that pasteurisation of white wines is less common than that of red wines. In addition to the action of heat, that of cold can be considered, but it can hardly be applied successfully by natural means. Cold has generally less influence upon the clarification of white wines than red wines, although it is by no means negligible. The activity of organisms living in the wine, yeast or microbes, becoming diminished, if not completely arrested, these organisms are more easily deposited. Then the organic matters fall more quickly, besides the precipitation of all matters in suspension is hastened by the formation of the deposit of cream of tartar crystals.

III.

The preceding considerations apply to wines of which the evolution is normal, but there are many circumstances where this evolution is altered by diverse causes which more or less affect the natural clarification of the liquid.

Cloud Caused by the Action of Microbes.

It sometimes happens that, instead of diminishing, the opalescent cloud in young wines increases until it almost returns to its original milky appearance. Shaken up in a glass, silky threads are visible, and the microscope shows the presence of a large quantity of bacteria, more or less closely joined together, which are the microbes of "tourne" (turn).

This state of the wine is most frequently seen when the condition of the grapes has been rendered defective by diverse causes such as hail, insects, fungoid diseases, or else when the fixed acidity is insufficient.

Thus wines of inferior quality, such as pressings, which are (*) always more watery than wines run from the vat, are particularly liable to this microbian invasion, and consequently are more difficult to handle and mature. Not only must this microbian action be prevented as soon as possible to have the wine clear, but also to prevent the effects of this action upon the flavour of the wine. This is not

(*) In France (Trans).

always easy in practice, and often necessitates a multitude of operations. First of all the acidity of the wine must be increased if necessary, by an addition of tartaric acid, followed by thorough aeration, and a heavy sulphuring. The activity of the microbes will thus be paralysed, and by the help of a heavy fining the elimination of the greater portion of the microbian cloud will be obtained, which will eventually disappear completely under the action of subsequent rackings. If these means are insufficient, recourse must be taken, as soon as possible to filtration or, better still pasteurisation, but it is necessary to only have recourse to pasteurisation after having used the other methods so, as far as possible to introduce into the apparatus a wine cleansed from the greater quantity of its impurities.

Ropy Wines.

In addition to the preceding microbian cloud, the wine is sometimes ropy or greasy, and the difficulty of clarification is much greater. Ropy white wines are common in some districts, and the microbian origin which Pasteur discovered is now known. However, this is not the only known origin, as certain varieties of yeast have been discovered which can contribute to produce this special appearance of the wine. But whether it is produced by microbes or yeasts it is easy to correct it. By aerating and beating up the wine the oily consistence disappears; an addition of tannin prevents its reappearance and facilitates the clarification by fining. This is not the case when the rope is due to a totally different cause to the preceding one, when it is derived from the grey rot of the grape. Dextrin, which is the mucilaginous product introduced into the wine by the *Botrytis cinerea* is refractory to a separation by the preceding method, and consequently makes clarification extremely difficult. The addition of tannin is useless. Aeration, if not always useless, can only be practised after the wine has been sulphured to prevent its breaking. As for pasteurisation it cannot be considered, for it would rather retard the separation of dextrin.

Natural separation becomes almost complete at the end of a more or less protracted period, for it is still in relation with the action of coagulation. It is slower with white wines than with red wines, probably because the latter precipitate more abundantly as they mature. Sauternes, which always contain this dextrin, should never be bottled until it is completely eliminated, or else with the coagulation continuing the wine may lose its initial limpidity, and a cloud is formed which congeals into small lumps not adherent to the glass. This floating deposit, which is somewhat difficult to separate, has none of the characteristics of the deposits due to the micro-organisms found ordinarily in wines. It can be found in wines of the finest quality which received every possible care, that is to say after three or four years in wood, the use of the most approved methods of

Note.—Some red and white wines made from American grapes and even certain European varieties in the South of France are sometimes ropy, because they contain an abundance of pectic matters which act like dextrin.

fining, even filtration, which gave the wine a maximum of limpidity, and the bottling being carried out under the most irreproachable conditions. This difficulty is extremely costly for producers of these high-priced wines, but they cannot, however, always foresee it. Luckily, it is fairly uncommon. To a certain extent it can be ascertained if the presence of dextrin is not overabundant in the wine about to be bottled. To a small quantity of the wine in a test tube add half the volume of strong spirit, which is well shaken up with the orifice closed with the hand. The mixture becomes always opalescent, but it is not this appearance that has to be considered. What has to be observed is the formation of a thread-like precipitate, which, when not very abundant, has the appearance of pieces of spider's web in suspension in the liquid. If this precipitate is produced there is the certain proof of the presence of dextrin, and the evident indication that the time of bottling must be retarded. Until now the influence of time alone is the only known means of obtaining this spontaneous precipitation, and it is evident that it would be useful to have an artificial method with more rapidity in obtaining the desired result. In our opinion it is in an appropriate filtration that the solution of the problem must be looked for. It is also by a proper filtration, as we will see further on, that the clarification of mucilaginous wines full of microbes is to be obtained.

Wines that Ferment.

White wines may be divided into two classes—dry and sweet. According to the wines and to the seasons, the small quantity of sugar remaining in the dry wines, when the yeasts lose their activity through a falling temperature, can be sufficient to give rise in the spring or summer to a secondary fermentation in the wine already clarified by several finings. This second fermentation naturally makes the wine cloudy, but if the yeasts which cause it are not accompanied by too many germs of disease it is soon over. This end is hastened by frequent rackings, and the final clarification of the wine is facilitated by sulphuring at this moment. For sweetish wines, such as Sauternes, where the first fermentation leaves often important quantities of sugar, the second fermentation, and consequently the clarification of the wine, would be interminable if we had to wait for its natural ending. There are yeasts of which the fermenting activity is very weak but the alcohol producing power very high. Thus it is not uncommon to find wines containing 27·75 per cent. proof spirit (we have seen them at 30 per cent.) which still contain sugar and still ferment. There is no advantage in allowing this fermentation to continue; firstly, because the wine does not clear, and secondly, because the excessive alcoholic strength diminishes the quality of the wine rather than increases it, since it is necessary to preserve the sweet, creamy flavour that is characteristic of Sauterne. To arrive at this result numerous rackings and sulphurings are employed. On account of the sulphur the wine becomes an unfavourable medium for the yeasts, which, losing at first their vitality, fall into the lees and are eliminated by rackings. At the end of one year, or perhaps two, not only do these sweet wines no longer

ferment under the influence of the original yeasts which they contained, but all new fermentation from germs introduced from the outside is impossible, as the wines contain such a quantity of sulphurous acid that no development of these germs can take place. This quantity is so high that it has sometimes created difficulties with Sauterne wines through certain rigorous restrictions in foreign countries. While protesting against this unreasonable restriction, it may well be asked if it would not be possible in this special kind of wine making to obtain the same results while using smaller quantities of sulphurous acid. Besides it is certain that many growers abuse, uselessly or ignorantly, the sulphuring of their wines. Various modifications of this old custom have already been proposed, amongst them the doing away with sulphur, and replacing it with carbonic acid gas. This substance is in practice inapplicable, and the general opinion is that sulphurous acid must still be the basis of Sauterne making, for there exists no other antiseptic as efficacious, as easily used or as harmless. We are of the opinion that in making a more reasonable use of this substance the quantity used can be diminished. This question is worthy of the immediate commencement of experiments, because they will necessarily be of long duration, and it is according to the following programme that we would suggest their being carried out :—First racking will be practised as usual, care being taken to well aerate the wine before it is put into the sulphured casks. Then, immediately after this racking, or, at any rate, soon afterwards, the wine will be filtered by the special process indicated further on, so as to obtain the greatest limpidity possible. The casks receiving the filtered wine will be sterilized by either boiling water or steam, and heavily sulphured when cooled down. These two sulphurings so close together should bring the amount of sulphurous acid to such a proportion that all development of yeasts is impossible, and the small quantity remaining in the wine will soon become sterilized.

So as to try and keep the wine in this aseptic state as long as possible, that is to say to enable it to mature free from all new fermentation, the introduction of all living germs and yeasts, which may develop some time after the above operations, must be avoided since the initial quantity of sulphurous acid diminishes rapidly under the influence of oxidation, in the changing of sulphurous acid from a free to a combined state. This ulterior yeast production in the wine appears to me to be possibly prevented by means of some simple precautions such as the following :—

Only boiled bung cloths must be used to put on with the bungs, and the bungs and tap plugs must be cut off as if for export, and the hogsheads stacked bung sideways. The bung itself and the bung-staves for an inch or two round it must be painted with a concentrated solution of bisulphide of soda on which will be placed some sterilized wadding or cotton waste, which will be held in position by a bung tin. The tap plug will, of course, be treated the same

way. The wine, thus imprisoned, can reasonably be preserved for a long time without fermenting, but to prevent any surprises in this direction samples may occasionally be drawn from a spile hole, care being taken to dip the spile in the bisulphide solution before replacing it.

In accordance with the progress of maturing under these conditions trial bottlings should be made, the first immediately after filtration and the second sulphuring. Possibly after the wine has matured for a time, a second filtration may be necessary, which will naturally entail a final sulphuring of the wine. It is easy to understand that if the wine is thus rendered ready for bottling after three or four rackings only, or even after five or six rackings, the total quantity of sulphurous acid will be less than if it were treated in the ordinary way and received 12 or 15 sulphurings. In regard to the amount of free sulphurous acid it will be rapidly diminished in bottle on account of an incomplete saturation of certain elements in the wine which enter into combination with it. It is to be noticed that should practice confirm this theoretical programme there will be a distinct advantage in the reduction of the expenses of this special vinification.

Cloudiness due to the Action of the Air.

Exposed to contact with the air, white wine may rapidly become cloudy for several reasons:—

1. Diastasic casse (break) or yellow casse, which can easily be avoided by sufficient sulphuring.

2. Ferric casse, generally caused by the accidental contact of the wine with a metal, producing with the acids in the wine ferrous salts. The cloud is due then to the formation of an insoluble tannate of iron, and is blackish owing to the oxidation of the ferrous salts. This is easily remedied by a fining, preceded by an addition of tannin, and sufficient æration to precipitate the tannate.

3. Over fining, caused by repeated or defective finings, leaving a certain quantity of albuminous matters in the wine. These wines often remain bright in bottle and cask for a long time, becoming cloudy with less than an hour's exposure to the air, and the cloud increases upon the addition of tannin or upon heating the wine. The action of the air can be explained by the oxidation of tannin and albumen as we have seen above. The treatment is either the addition of tannin and aeration, or else pasteurization and prolonged rest.

Cream of Tartar.

Deposits of cream of tartar are frequent in wines bottled too young, even if preserved at a uniform temperature. Generally this crystallization does not interfere with the limpidity of the wine. The little crystals, rarely adherent to the glass, deposit, then gradually increase in size becoming a more or less brownish yellow. This precipitation is particularly easy with heavily sulphured wines. By its

oxidation, this sulphurous acid produces sulphuric acid which upsets the equilibrium of the elements of the wine in forming cream of tartar at the expense of the free tartaric acid, which all new wines contain more or less. As the wine is already saturated with cream of tartar, whatever is formed is precipitated. This precipitation takes place also in non-sulphured wines, but not so rapidly, for the free tartaric acid only acts slowly on the potassic combinations in the wine of less acidity than the wine itself, while in the presence of sulphurous acid the destruction of these combinations seems more easy.

3-colour process]

MONROE'S FAVORITE.

[Robt. S. Brain, Govt. Printer

A CELEBRATED SHIPPING APPPLE: MUNROE'S FAVORITE.

By Jas. Lang.

Syn. Dunn's Seedling, Gander's Seedling, Golden Cup, Garibaldi.—Fruit large, about four inches wide and three and a half inches high, roundish and even in its outline; skin deep yellow, with a fine clear waxy appearance, sometimes flushed with red on the side next the sun; eye small, closed, set in a rather deep basin; stalk short, and set in a deep cavity lined with russet. The tree is a strong vigorous grower, and attains a large size.

This apple first came under my notice in the year 1868, when in Castlemaine market one day I noticed some beautiful apples exposed for sale on a stall. On making inquiries I found that they had been grown by a miner named Munroe, residing at Strathlodden. They were very beautiful, and attracted much attention at that time. Some time afterwards I made the acquaintance of Mr. Munroe, when he informed me that the tree from which the apples came was growing in the garden when he purchased the place, whether it was a seedling or had been planted he did not know. I obtained scions of the variety from him, and worked a number of trees with it. When it fruited with me I sent specimens to Mr. George Neilson, Curator of the Royal Horticultural Society's Gardens, at Burnley, to see if he could identify it with any of the varieties growing there. He wrote me saying that it was quite distinct from any in their collection, and suggested that the name should be Munroe's Favorite. This was adopted, and it was registered in the Society's collection as Munroe's Favorite. A Mr. Gander, of Doncaster, afterwards claimed it as his seedling, but, in the opinion of Mr. Neilson, he failed to substantiate his claim. I also found that it was largely grown in the Bendigo district under the name of Garibaldi, and was also very highly esteemed as one of the finest of apples. It was also known in the Diamond Creek district as Golden Cup. Dunn's Seedling of South Australia is also the same apple.

The true origin of this beautiful apple may, perhaps, never be definitely known, but it seems to have been a great favorite in different parts of the State. It has also proved itself to be one of the very best export apples, having a beautiful waxy appearance when ripe.

In this connection it may be well to quote the opinion of the late Mr. F. D. Barnes, Managing Director of the P. & O. S. N. Co., London, to whom I sent two cases of different sorts in the year 1889, amongst which was Munroe's Favorite. He says:—"Munroe's Favorite turned out simply perfect, just like wax, and beautifully yellow. Munroe's Favorite I should send, because it is the most beautiful apple I have ever seen." The place now taken by Munroe's Favorite as an export apple fully justifies the opinion expressed by Mr. Barnes fourteen years ago, while my own opinion is that it is the best commercial apple in cultivation in Australia.

APPLE GROWING IN TASMANIA.

By J. Knight.

Stocks Used and the Treatment of the Trees.

When attending the recent meetings of the Fruit Nomenclature Committee at Hobart, last April, opportunity was afforded members for visiting the various fruit-growing districts, and in the course of the tour which was made every facility was given to see the methods of growing, packing, and shipping. Much may be learnt by a visit to the fruit growing districts there, as the practice differs materially from that adopted in Victoria.

The system of raising trees is not one that can be recommended, the old practice still exists of using seedlings as stocks, and, in many cases, the stock has become so unsightly as to resemble the club or mallow root form. Beyond the slight saving in raising stocks, there seems no advantage in this over the Victorian system of blight proof stocks. Here and there trees may be seen growing which have been imported from this State, but, for some reason, the advantages of a clean stock are not appreciated by growers, notwithstanding the freedom of the stock from blight.

The first thing to strike a visitor on entering the orchards is the stunted character of the trees; this is not through any defect or want of skill in treatment, but is the result of a system deliberately adopted. In the first place the trees are planted much closer than here, with usually, between 200 and 300 trees to the acre, at intervals of 12 to 15 feet. And again, the training differs, as the trees are shaped to branch out near the surface, and have a dense coating of fruit-bearing spurs from ground to top, and it is claimed for this that the picking and gathering is much more easily accomplished, as it is done from the ground. The general appearance of the tree would remind one of Morgan's Seedling with its line of fruit from top to bottom, and, from a Victorian point of view, the fruit would be regarded as somewhat stunted or undersized.

With trees planted the distance given, in a climate such as exists there, one may expect a fair return, but I was not prepared to hear of what appeared to me as extraordinary yields. In some cases 700 to 800 bushels per acre were recorded, but 300 or 400 appears to be about the average with most varieties.

An extensive list of varieties were formerly grown, but these are now limited to a few only, and among them are the Sturmer Pippin and the Scarlet Nonpareil. These two varieties are the principal ones now cultivated as they have been found to be specially adapted for the soil and climate.

Some Natural Advantages.

Whatever disadvantages the fruitgrower may have through the rugged nature of his country, there is a wonderfully compensating

condition which favors him. Throughout the whole of the fruitgrowing districts twining about among the hills there are navigable streams, and it is along the banks of these that the orchards are planted, and at various intervals small jetties may be seen running out in the stream from which the cases of fruit are delivered to the steamers and taken by them direct to the wharf at Hobart, where the mail boats and other large ships are enabled to come to the wharf and load. It is one of the sights of the country to see the enormous stacks of cases delivered there for shipment. During my stay in the city the *China* and *Aberdeen* were loading with 70,000 to 80,000 cases each. The work proceeds in a steady and careful manner, and it is quite clear that the shipping of apples is looked upon by steamship companies as a trade worth catering for.

Packing the Fruit.

Along the river banks may be seen, here and there, large packing sheds. The fruit is brought in from the orchard fresh from the pickers, and packed by boys and girls on piece work and day work, the price usually paid being 1d. a case. Packers are supposed to reject any defective or undersized fruit, but when we see the system there of rushing the fruit in, it will be readily seen that grading does not receive much attention. A number of boys and girls pride themselves on being able to do their 100 cases a day on an average, but with some of the more careful shippers the number is limited to 50 or 60.

In passing through the packing sheds one cannot help regretting that more care is not exercised in keeping up the standard of quality. In most cases everything appears to give place to expedition in working, no doubt this is important where so many thousands of cases have to be prepared and shipped at a short notice. Stress is laid on the fact that their apples are picked, packed and shipped fresh from the trees. To many, the wisdom of this is questionable. Their season of maturing being later than ours no doubt contributes to this practice, as the shipping to the old world has to be completed in April or early in May. Their choice fruit cannot be gathered earlier. The system to my mind emphasises the importance of our giving proper instruction in the general treatment of all export fruits. The necessity for inspection is clearly shown by the somewhat careless system of shippers in the Tasmanian trade, which must ultimately tell against them when competition with other states becomes more acute.

The Tasmanian Case.

One of the great advantages which the Tasmanian apple shipper has, is in the nature of the cases in which he ships his fruit. While they do not look so well as those used in Victoria, they are nevertheless much better for protecting the fruit, as the timber is stronger and more rigid than the light wood cases made here. The cases are made in the packing sheds from the ready sawn timber, and 1d. each

is paid for putting together and trimming. The total cost delivered at the orchard is from 5½d. to 6d., while in Melbourne it is 19½d. The mills cut and deliver the stuff at Hobart in the flat in proper lengths for 4d. and 4½d. a case, and there is no reason why a similar practice should not be adopted in this State. We have timber equally well adapted for the purpose, and facilities for obtaining the same, and a saving of 4d. or 5d. a case is well worthy of consideration by our orchardists. It is proposed to make enquiries at the mills when time permits, to see if this cannot be accomplished.

The keen competition which may be expected in the export of fruit necessitates economy at every point. I do not think that this State has anything to fear from competition, but every care should be taken to keep up the standard, as by that means only can we expect to succeed. In my opinion, Tasmania will require to alter her methods, which appear somewhat careless, the tendency is to go in for quantity rather than quality.

System of Loading.

I was interested in the method of loading the fruit, and during my visit there I was fortunate in seeing two large vessels taking fruit on board. I could not help noticing the careful way in which the cases were handled; the cases of fruit are placed in barred slings and no pressure is brought to bear on the sides of the cases, as, unfortunately, is the case when loading here. Twelve cases are packed on two bars, the ropes are fastened to each end, and the weight of the cases is on the bars alone, but I am informed that the mail companies have a much more objectionable system and that the cases are placed in nets in large numbers, and a case was shown to me in which the sides were staved in by the pressure of the adjoining case, but the company still insist on loading in that form.

The only objectionable feature observed in loading the fruit, was that though the fruit was being lowered most carefully, the stevedores below tramped over the sides of the cases in travelling to and fro with a heavy case in their arms, there were no planks or other protection, they simply walked on the cases. No doubt this largely contributes to the occasional damage we hear of in reports of the condition of fruit when landed in London. A few planks laid down would obviate all this, and it is somewhat surprising that the shippers have not been able to secure such a needed reform. I think this is worthy of special attention, as the practice is carried on in this port, and with the soft wood cases such as ours, the damage must be considerable.

Method of Marketing.

The export of fruit in Tasmania has been fostered chiefly by two firms in Hobart, which secure the space from the shipping companies, hence the shipments have to pass through their hands. Many of the sheds referred to along the banks of the rivers are owned by them, and the fruit is purchased direct from the growers, and packed and

shipped by these firms. During the last two years, however, outside boats have been seeking a share of the trade, and a few of the large growers have shipped direct, and the hope is freely expressed that this system will soon become general.

Prices Realised.

The price realised by the grower at the packing sheds during the last year or two has been 3s. a case, which is regarded as being quite satisfactory, but there are many instances in which the grower provides the case and paper, besides packing and delivering at the wharf at Hobart. With these the grower is provided with his own sheds, and, as a rule, the packing is more carefully done as the work is supervised by the grower, or done with the aid of his family, a system now becoming more general. Under these conditions 4s. per case is paid for the best shipping varieties. In some instances the firms referred to ship for the grower at a charge, by way of commission, of 3d. a case.

Extent of the Trade and Probable Expansion.

At the time of my leaving, 500,000 cases had been shipped, and it was considered that there would be about 800 cases additional before the close of the season, which would extend to the end of April. This however, by no means covers all shipments from Tasmania, as heavy consignments are sent to inter-state markets and elsewhere, and it is estimated that over a million bushels would be available for shipment after the English market had closed.

In driving through the various districts one is struck with the enormous increase in the area planted. In all directions newly planted orchards may be seen, and extensive areas being prepared for the reception of trees, but, as before stated, planting is limited to the valleys; the hills and back country being regarded as unsuitable.

Freedom from Pests.

The freedom from pests, insect or fungus, shows the great advantage the Tasmanian growers possess over those in this and other States. It is claimed by them that disease has been stamped out. If such is the case, there is a prospect of our own product being considerably improved, but I am under the impression that their climatic conditions are not so favorable for its development as here. As in the case of codlin moth, there it is understood that one brood only in the year is produced, whilst here, it is found necessary to protect the fruit, by spraying, from setting to gathering. As to black spot, which gives such trouble here, there is not much to be seen anywhere through the orchards, and spraying is but little resorted to. Scale shows itself here and there, but that also is kept well in hand.

Bye-Products of the Orchard.

I may say that I am somewhat disappointed in finding the want of energy amongst the Tasmanian orchardists in the way of not utilising what may be termed their waste product. The heavy loss sustained annually in this respect is considerable. Hundreds of tons are simply wasted, with little or no attempt to make use of them.

I visited two factories in which drying was attempted, and have no hesitation in saying that if proper care was bestowed in this line alone a considerable increase in the returns to the orchardist might be made. I also visited a cider making establishment, which is carried on in a limited scale, and in this also there is room for improvement. If the outlet for this class of product were properly attended to it would result in immense benefit to the orchardists of that State.

As to fruit vinegar, I was unable to find any attempt being made to supply this to the trade. In one or two instances I was informed it was made in the home for domestic use, but there was no attempt to develop a trade. These minor outlets are worthy of consideration from our own orchardists, and those contemplating entering into the business may rest assured that they have nothing to learn or fear by way of competition from their neighbours across the Straits.

CLEOPATRA APPLE AT MR. KEIR'S, HIGHETT.
(Sprayed Twice.)

[R. S. Brain, Govt. Printer.

STONE PIPPIN AT MR. KEIR'S, HIGHETT
Not Sprayed.

FRUIT NOMENCLATURE.

By J. Knight.

The committee representative of the various states appointed to revise the nomenclature of apples and pears met at Hobart in April last, and carried out the work entrusted to them.

The display of apples made at the show of the Council of Agriculture was an excellent one, but pears were somewhat deficient. As to other fruits few or none were displayed. Preserves were not exhibited, and the exhibition may be regarded as an apple show only, and in this respect there can be no doubt as to its being satisfactory. The general appearance of the apples went far to show that Tasmanians had nothing to fear from the neighboring states in its export trade in this product.

The method adopted by the committee was to check the local name or that under which the fruit was exhibited, with that recognized by the members of the committee, but something more is necessary to make this work complete, as fruits vary considerably when grown under differing conditions, and mistakes are almost certain to occur when the selection is confined to a few specimens picked for show purposes, such as those at the Hobart show.

This work should be undertaken in a more thorough manner, and a small committee formed in each State, by which specimens of the various kinds and varieties of fruits could be collected and described, and a comparison made with those produced in other states, when a general description could be given, enabling ready identification of any specimen to be made.

Amongst the members of the committee there was a general expression of regret that this work of fixing the nomenclature of fruits was not taken up from a national point of view, and a recognized standard fixed for all States. The present system of shipping the same varieties of fruits under various names is confusing, not only to the export trade but also to the nurserymen who have to supply trees. Endless confusion results as the grower markets the fruit under the name of the trees which were ordered, and serious disappointment is met with in finding, after years of waiting, that the produce was not what was intended.

It was considered advisable that each State should collect specimens of typical fruits with written descriptions of each, and that these should be compiled by an inter-state committee, so that, accompanied by suitably colored illustrations, a standard work would be formed suitable for all states. It was suggested that if the Agricultural Departments of the States were to undertake this work the matter could be first utilized for the various Journals and supplied to the public in numbers as published. It was thought by this means much of the confusion now met with would be avoided and the fruit industry improved.

TUBERCULOSIS IN ITS RELATION TO THE DAIRYING INDUSTRY.*

By J. R. Weir.

History.

That this disease has been known to exist in the earlier ages of the world there is abundant evidence, and of its prevalence throughout the animal kingdom, as then known, there is equally convincing proof from the fact that even in those ages there were enactments against using the flesh of animals affected with it. The Mosaic law cautions the Jewish people against the use as food of animals affected with "wens," (Friedberger, also Stockman). Later on in the history of Europe in the ninth century, ecclesiastical laws forbade using the flesh of such animals. During the middle ages, it was supposed to be connected with human syphilis, and in consequence of this theory of origin all tuberculous cattle had to be destroyed, and severe penalties were enacted against the violation of the sanitary laws (Frohner).

Distribution.

In so far as is known the disease is spread throughout the world, and statistics prove that animals in the immediate vicinity of cities suffer more than those in country districts. Next to man, it has been found that milch cows are the most subject to it, and these latter, having such a strain imposed on their vitality by continuous milk production, are more prone to be affected than other classes of cattle. It has already been stated that cattle in cities suffer more than those in country districts, from the fact that they are for the most part housed, whereas in the country the milch cows have very much more fresh air, and at the same time their vitality has not been undermined to such an extent by producing milk in such quantity or for so long a period without respite as those in towns. Janson states that this disease is unknown in the native cattle of Japan, but that cattle imported there or crossed with the native breed contract the disease. Some German authorities assert that in certain districts in that country, where care and attention is bestowed on the selection, breeding, and after-management of the herd, that this ailment is unknown. Apart from such statements as these, which in many cases lack confirmation, tuberculosis claims its yearly roll of victims, and I am happy to state that I believe Australia enjoys a premier position in respect to the percentage of animals so affected. In our own State, where, as you are aware, the dairying industry has within the past few years made such rapid strides, the reports furnished by the officers of my branch point decidedly to the fact that its occurrence is on the decrease. Statistics of other

*A paper read at the Annual Meeting of the Butter and Cheese Factory Managers' Association, May 20th, 1904.

countries and reports furnished periodically by the various inspectors point to certain types as being more predisposed to this disease than are other breeds, and this, as previously stated, I attribute to the heavy strain imposed in producing large quantities of milk. As it has been fairly proven that while the disease is rarely transmitted hereditarily, there is a marked predisposition that the progeny of a tubercular animal will later on develop the same complaint as the dam.

Etiology or Cause of Disease.

It has been demonstrated by Koch that this disease is due to the presence in the tissues of the body of the tubercle bacillus, but the conditions under which the tubercle was transmitted to the animal may vary. Perhaps it is by means of the coughed up tubercular matter from an affected animal which has been deposited on the grass which is eaten by another animal, or may be by animals licking each other as stated by Bang. Comet, Celli, and other investigators, state it is hardly possible that it has been exhaled into the air by one animal and inhaled by another in a pure condition. In animals shedded or stalled in byres, it is evident as will be shown later on that one affected animal may infect all others in the same shed by the coughed up sputum drying, and being blown over the food which the other animals are eating. Or again, anyone supplying milk to a creamery who was milking an animal affected with tuberculosis, and selling it with the milk of other cows, is disseminating the disease broadcast among not only his own but his neighbours' calves and pigs, which feed on a mixture of such milk, this the more so if the disease exists in the udder of the animal, although the milk may produce simlar results from the animal so affected even though the udder is not the seat of disease. Various continental investigators have proved that dairy produce (whey, cheese and butter) from animals suffering with this disease may cause it to be transmitted even after a lapse of as much as four weeks. Bang affirms that he has proved that milk which has been skimmed by a separator loses a lot of its tubercule bacilli through their being driven into the sediment. This process does not afford absolute protection, as skimmed milk and cream so prepared have been found on inoculation capable of setting up tuberculosis. Milk does not in every case afford positive results microscopically of the presence of the spore or bacillus of tuberculosis, yet by inoculation with it the disease has been set up in other animals. Bollenger, from the milk of 20 affected cows, was able to detect its presence in one sample by the aid of the microscope, although by inoculation experiments he introduced it in 11 cases, and the researches of many others have been attended with similar results.

Having thus seen how readily bovine tuberculosis may be transmitted among cattle, and we are aware that tuberculosis claims each year such a number of human victims, I hope I may not be considered empirical in bringing under notice the opinions of many eminent scientists of the relationship which exist between the bacilli of the disease in man and other animals. When Dr. Robert Koch first

pointed out that this disease was in all animals due to the presence of the *Bacillus tuberculosis,* he indicated that in all animals it was uniform. This was in 1882, but in 1901 he affirmed (1) that human tuberculosis differed from bovine tuberculosis, and that human tuberculosis could not be transmitted to cattle, and (2) that owing to the infrequency of the transmission to man by milk or meat of tubercular animals any more than hereditary transmission it was unnecessary to take steps to prevent it.

Professor Nocard in 1897 and 1898 conclusively proved that the two bacilli were only varieties of the one species, and the use of unboiled milk for children was strongly condemned by him. At the Congress on Tuberculosis in Paris opened on the 25th July, 1888, it was carried unanimously that the meat of tuberculous animals should be destroyed *in toto,* and if the meat from such an animal, which must be cooked before being used, was in the opinion of this learned body of scientists deemed so deleterious to public health, how much more so the milk from such a one, when it is so often used unsubjected to sufficient heat to destroy the bacilli. Professors Virchow and Gerlach have drawn attention to the frequency with which milk is infectious, and the danger attending its consumption by human beings. In an address by Professor Walley, Principal of the Edinburgh Veterinary College, before the Medico-Chirurgical Society at Edinburgh on 15th February, 1888, he stated, "Milk is undoubtedly the medium through which transmission is most likely to take place." This fact seems to have been borne home to that gentleman, as he stated that shortly after his arrival there he had lost a child through *tabes mesenterica,* induced in his opinion by milk with which it was liberally supplied. That this was the medium of infection, Drs. Taylor and Stevenson Smith were also of opinion. In various continental cities, where pasteurized or sterilized milk is more commonly used than in London, it is found the percentages of cases of abdominal tuberculosis in comparison to phthisis is far less than in Great Britain where these precautions are not so universally adopted. Dr. Sims Woodhead draws particular attention to the number of young children he has found affected on post mortem examination with abdominal tuberculosis. Dr. Littlejohn, at the same meeting as Professor Walley, said, "I think it cannot be doubted that this formidable disease is communicable from the lower animals to man." Professor Greenfield at this same meeting said, "As regards bovine and human tuberculosis, I cannot bring myself to believe, or rather I cannot find that there is any certain mark by which one can distinguish bovine from human tuberculosis." I might go on quoting authorities indefinitely in various parts of the world whose opinions coincide with those I have quoted, and coming near to the present time I will give you the views of a few more scientists trained in the highest seats of learning, and holding advanced opinions formed as the result of years of patient investigation, combining not only theory but also the result of practice in their professions either as medical or veterinary practitioners. But more recently, we find in *The Veterinarian,* September, 1899, in a report of the National Veterinary Association held

at Plymouth shortly before, that the President of the Royal College of Veterinary Surgeons, Mr. Frazer, moved the following resolution, which was carried unanimously, "That this Association, being convinced that bovine tuberculosis is a danger to man, and a source of enormous loss to owners of cattle, is strongly of opinion that State control of the disease is urgently wanted in the interests of the public health and agriculture."

Coming nearer still to the present time, Professor Cruikshank, in his work on "Bacteriology and Infective Diseases," summarizes the result of his investigations in this subject as follows:—"Direct evidence of the transmission of tuberculosis by milk to man is wanting, but from the effect of such milk on the lower animals it is reasonable to conclude in the present state of our knowledge that there may be danger in using the milk of cows with tubercular udders, and therefore strict inspection of dairies should be enforced, and boiling of milk before use will as a rule be a wise if not absolutely a necessary precaution."

Exhaustive experiments have within the past few years been carried out at the instance of the United States Government, by mixing sputum from consumptive patients with the food of control animals, and in every case the post mortem examinations on the animals proved they were affected with tuberculosis in one or another form, many of them being identical with that found in the human patients. In the *Journal of Comparative Pathology and Therapeutics*, Vol. XVI., Part 2, in a paper on the "Experimental Demonstration of the Unity of Tuberculosis" by Professor Arlung, it is stated "As the result of the general examination of a series of 46 experiments made by him, 33 with human bacilli and 13 with animal bacilli, on various subjects that the results were positive in every experiment," and concludes his paper thus, "The identity of human and bovine tuberculosis ought to be maintained and the prophylactic measures which result from it ought also to be maintained, notably with regard to the use of milk." In the annual report of the New Zealand Department of Agriculture for 1903, in a paper on "Bovine Tuberculosis in Its Relation to Man" by Mr. J. A. Gilruth, Pathologist to the Public Health Department there, the author, after quoting numerous authorities to support the identity of the human and bovine tubercle states, "There are many authenticated instances where infection of human beings with tuberculosis, both through the skin and through the alimentary tract, has occurred from what all available evidence points to be a bovine tubercle." Of course you are aware that it is not possible to decide the point at issue experimentally by the direct transmission or inoculation of the bovine tubercle into the human subject, from reasons which it is not my province to discuss.

Measures Taken to Stamp out the Disease.

In this State the measures taken for stamping out the disease are slaughter of affected animals, although often the carcases of such

animals, when in the opinion of the officer supervising the slaughter the disease is merely local not generalized, are allowed to go into consumption with the exception of such portions as show the lesions of the complaint. This practice is in accord with that prevailing in many parts of the world where attention has been paid to the matter, it being considered that the heat required in one or other of the processes of cooking to which the flesh of animals is submitted would be sufficient to destroy the few bacilli present. This, with the value of the animal as an article of food, being considered as sufficient reason why carcases in which generalized tuberculosis is not present should go into consumption, although many high authorities are of opinion that an animal in any way so affected should not be allowed to be used as food for man. In the United Kingdom the Board of Agriculture, founded in 1889, has, as the result of the recommendations of the Departmental Committee which met by the direction of the Privy Council in 1888, taken active measures to stamp it out, and among other recommendations was that power be given to inspectors to slaughter for this disease as for pleuro-pneumonia. In Germany the same conditions relative to the use of meat from such animals prevail as in this State, as also in France, Italy, Denmark, Austria, and the United States of America. This disease being as I have already stated in some instances hereditary, and as preventive measures are much more satisfactory in dealing with it than curative, it is well to begin at the fountain head (1) by not breeding from any animals which there are reasons to believe are affected, (2) by the early slaughter of animals the progeny of stock which have been found to be so affected, (3) by the isolation of any beast which there is reason to believe is so diseased, and the speedy slaughter of such an animal.

In proof of the heredity of this complaint, an instance recently came under my observation in this way. An officer of my branch condemned a newly calved cow for tuberculosis, which on autopsy proved the truth of his diagnosis. Feeling suspicious that the calf may have inherited the disease, he purchased and killed it, not content with naked eye examination which rendered the fact patent enough. Some portions were submitted to Dr. Bull for bacteriological examination, and were found by him after patient investigation to be highly involved with tubercular deposits, and as the calf was but two days' old at the time of slaughter, this gentleman in his report was decidedly of opinion that the disease was contracted by it from the mother prior to its birth. Treatment as I have stated, unless in the very early stages, is useless. Calcification of the affected tissue will sometimes set in, and while causing a local death of the parts is a reparative process, and prevents the further spread of the disease in at least such portions of the animal's structure. Whilst engaged in the preparation of Professor Koch's Tuberculin, Merck of Darmstadt (see *Veterinarian*, June, 1900) found that, by subjecting the bacteria in glycerinated bouillon to a greater heat than was required to produce the tuberculin, there was a diminution of the poison in it to what there was in that prepared at

the proper heat. This material he named Tuberculol, and it was thought by some scientists who had conducted a series of experiments that this product would serve a twofold purpose, as being not only of service for the treatment of animals affected with tuberculosis but also as an anti-tuberculosis serum, which would confer immunity from the disease. Whether this will pass beyond the stage of laboratory experiment I am not informed, but should it do so it would prove of untold value to man and beast alike.

Symptoms.

The diagnosis of the disease in its early stages is with the exception of very few cases exceedingly rare, as the progress made by the disease although very slow is yet certain. It may occur in any organ of the body, and in the lungs it shows itself by a weak dull cough in the early stages occurring in short jerks. As the disease progresses this becomes more distressing, discharge from the nostrils and expectoration being very rare, but most severe in the morning or after unusual exercise, when through dilatation of the bronchiæ or breaking through of the cavities of the lungs there is a discharge accompanied by coughing, and the expired air has a bad smell. As the disease progresses the hair loses its gloss and the skin feels hard to the touch, and later on the animal becomes hidebound although it may be years before the animal becomes so emaciated. It is to be observed that even in its advanced stages, it has been found impossible to diagnose the disease in many cases. This fact I have found from actual experience, and reference to many high authorities substantiates my statements. Friedberger asserts it is because tuberculosis does not possess characteristic symptoms. But when the symptoms I have given are exhibited with or without the enlargement of the external lymph gland the animal must be viewed with suspicion, the more so if a female. Tubercular animals very frequently abort, more so when the serous membranes are involved or they may be sterile, yet oestrum seems constant, but it is when the udder becomes affected to a great extent that the matter will be brought more definitely under your observation. Coming on slowly and gradually in the udder it continues, beginning most frequently in the upper portions of one quarter which extends gradually in size, and upon pressure of which the animals feels no pain and the affected quarter shows no heat or redness. This is most particularly to be noted when an udder becomes swollen and painful within the course of a day or two, and which upon pressure is found hot and the animal shrinks upon being touched there, but this must not be confounded with tuberculosis even though eventually it becomes shrunken and blind, as this may be unhesitatingly pronounced non-tubercular. The tendency of the tubercular udder is to increase in size, and the supra-mammary glands will as the disease progresses be found upon feeling them hard and nodular to the touch. The milk in the early stages may not be deficient either in quantity or quality although the bacillus be present, but later on, as its invasion becomes more pronounced, the quality

decreases, and as the quarter increases in size the milk becomes thin and watery with flakes or strings of curdy matter suspended in it until finally what little can be drawn from such an udder or quarter becomes very thick.. In the report of the Research Laboratory of the Royal Veterinary College, London, for the year 1899 (*Veterinarian,* May 1900) it is stated that one of the negative characters of tuberculosis is that the diseased quarter never bursts or discharges matter.

Of the value of the tuberculin test as a diagnostic for tuberculosis there is a conflict of opinion among scientific men, it having been found that an animal although not affected with tuberculosis may react. This has been definitely proved in a number of cases after the animals have been slaughtered. In many affections of the lungs and liver—hydatids, actinomycosis, and other similar diseases—as also in inflammation of the udder, this reaction has been found to take place. At the instigation of Professor Bang, the Danish Government supplied tuberculin and supervision gratuitously for some years. Friedberger, who states tuberculin is not to be regarded as a specific diagnostic agent for tuberculosis, adds however that it may be used with advantage for diagnostic purposes when selecting animals for breeding, and as a prophylactic for combating disease in large herds.

A CHEAP TICK PROOF FOWLHOUSE FOR FARMERS.

By A. A. Brown, M.B., B.S.

The building, which should face the east, is constructed in pyramidal or tent form, 8 feet square by 7 feet high, and the drawings which indicate the details of construction have been prepared by the Public Works Department.

The bottom plates at sides and ends marked A should be 3 in. by 2 in. hardwood, those at sides to be sloped as shown. One 3 in. by 2 in. hardwood purlin or cross rail, marked B, should be placed at each side to strengthen the ends. The ridge at C should be 4 in. by 3 in. hardwood shaped Λ as shown. The ends should have two sloping and two vertical uprights, and cross rail on top, marked D, constructed of 3 in. by 2 in. hardwood, and the whole building should be strongly framed and spiked together.

To hold down the building, No. 12 1 in. by 5-16th in. wrought iron spikes, each 10 in. long, bent and screwed to the under side of bottom plates, should be provided as shown at A, or 3 in. by 2 in. hardwood pointed stumps could be used.

The door frame, which is 4 ft. 3 in. by 2 ft. 3 in., should have 3 in. by 1½ in. hardwood stiles and rails, and 2 in. by 1½ in. hardwood brace strongly spiked together and hung on two 14 in. iron tee hinges.

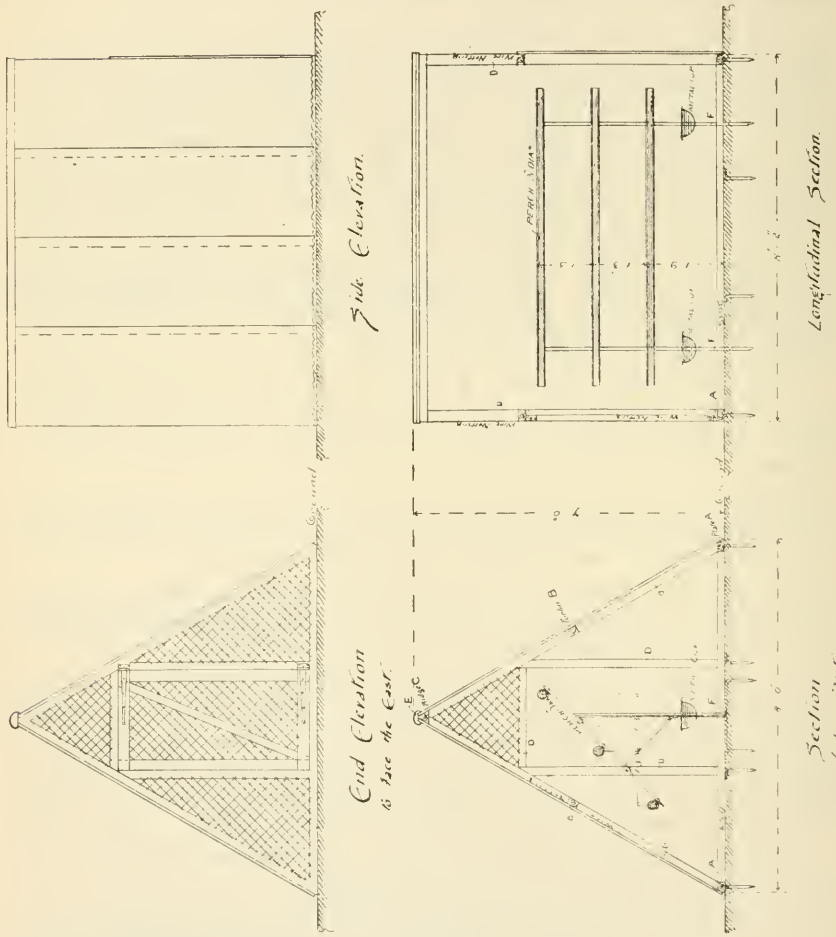
The whole of the east end of the building and door, and the whole of one side and the space above the cross rail at the western end, should be covered with wire netting of 2 in. mesh.

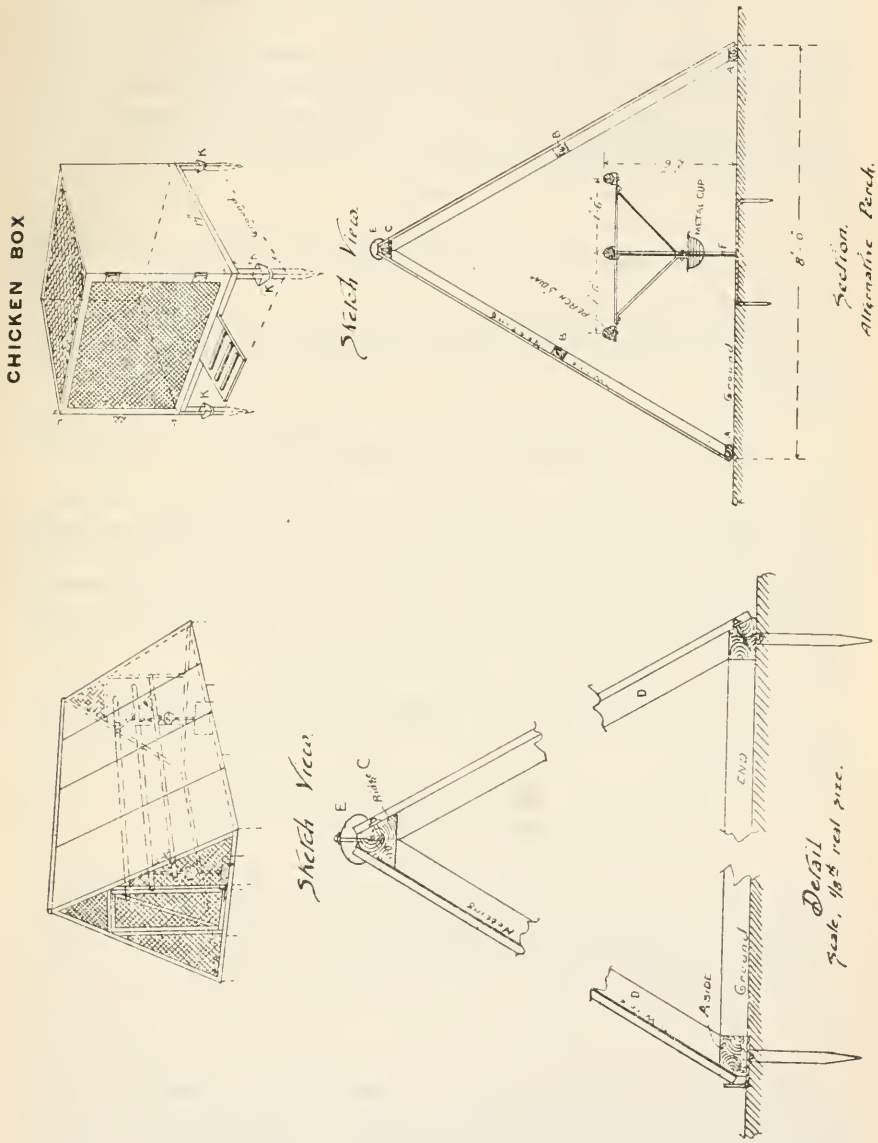
The whole of the two sides, and the space under the cross rail at the western end, should be covered with 26 gauge galvanised corrugated iron, which should have a lap of one corrugation.

The sheets on one side (on which winds are least felt) at each lap to be held in position with wrought iron clips, screwed to bottom plates, so that the corrugated iron sheets can be easily removed in summer to make the shed of a more open character. The sheets on the other side, and at the western end, are to be secured to the framing with screws and washers in the ordinary way.

The ridging should be of 22 gauge iron, curved as shown at E, aud secured with No. 5 screws and washers.

The stand forming sloping perch should have two uprights formed of 1¼ in. angle iron, split and forked at foot as shown at F, and 1 in. by 5-16th in. wrought iron arms, brackets and rests for perches, the whole to be riveted or bolted together, or 3 in. by 2 in. hardwood well tarred can be used in the construction of stand for perches. A sketch showing a perch that can be erected in horizontal fashion is also illustrated, and if the alternative design is preferred efficient protection is afforded to the fowls from infestation. The perches are to be 3 in. diameter, Kauri pine tarred, and supported on rests so as to be capable of easy removal.


Side Elevation
End Elevation
Longitudinal Section
Section


CHICKEN BOX
Sketch View
Sketch View
Section.
Alternative Perch.
METAL CUP
8' 0"
Detail
Scale, 1/8th real size.
END
Ground

Metal cups shown to be strung on iron uprights and soldered, and filled with formalin, kerosene or phenyle, as recommended in previous article. If wooden uprights are used the cups should be so made as to be easily slipped over the supports and fitting close to the woodwork all round. The whole of the woodwork should be tarred before being placed in position, and the inside of iron sheeting should also be treated with tar. The outside of the ironwork should be painted white with Arabic paint to keep the building cool in summer.

The weight of fowlhouse will be about 3 cwt. and the perch stand ½ cwt., and the building is so designed as to be capable of removal from point to point when desired.

Chicken Box.

To prevent sitting fowls from becoming infested with tick, a sketch of a tick proof box is furnished.

The box should be constructed of soft wood ⅞ in. in thickness and 20 in. by 15 in. by 20 in. high (clear inside space), open on top and at one side.

A framed door hung on a pair of 3 in. hinges, and secured with a turn button, should be provided to keep the fowls in. The door, and the top of the box, should be filled in with 1½ in. wire mesh netting.

The box should be supported on No. 4, 2 in. by 2 in. hardwood legs, 15 in. long pointed at bottom, with 2 in. by 2 in. hardwood plates fixed on top of same. A sloping board 9 in. wide and 15 in. long is fixed to the box so that it will be 1½ in. above the ground, to permit of chickens easily jumping thereon, and should be supported on two light bearers blocked out from plate, and 1 in. by ⅜ in. battens fixed on same to prevent the chickens slipping off.

Metal cups fitted close to the woodwork all round should be placed on the supports as shown at K, and should be kept filled with kerosene, etc.

Estimate of Cost of Tick Proof Fowlhouse.

VALUE OF MATERIAL.

8 sheets Corrugated Iron, each 8 ft. x 2 ft. ...	2s. 9d.	
3 " " " " 5 ft. x 2 ft. ...	1s. 6d.	£1 6 6
24 yards 2 in. mesh Wire Netting, 3d. per yard ...		0 6 0
110 lineal feet 3 in. x 2in. Hardwood		0 5 0
3 Perches, each 1s. 6d., 4s. 6d.; Hardwood Stand to support same 2s.		0 6 6
		£2 4 0

Note.—If iron spikes, instead of hardwood pointed stumps are used to hold down the fowlhouse, then 12 valued at 6d. each—6s. An iron stand for supporting perches is valued at 9s., so that if an iron stand is used instead of a hardwood stand valued at about 2s., the cost of construction is increased by about 13s.

The tick proof chicken box, 20 in. by 15 in. by 20 in. high, clear space inside, is estimated to cost 15s.

BLACK SPOT EXPERIMENTS, 1903-4.

By D. McAlpine.

From the valuable report on the rainfall of the year 1903 in the May *Journal*, by Mr. Baracchi, it will be seen what an exceptional season it was, and how unequally the rain was distributed over the several months. For the preceding seven years, from 1895 to 1902, the drought was more or less general, not only in Australia, but also in India, East and South Africa, and elsewhere, and in the opinion of the late Director of the Indian Meteorological Department it was parallelled, "so far as we are aware, only by the seven years of famine in Egypt of Biblical history."

The season, while generally favorable for growth, was particularly suitable for the development of fungus diseases such as black spot, and not only so, but in many instances, the attacks of this fungus were continued unusually late, even till the fruit was almost fully formed.

Late Development of Spot.

In a large number of orchards there was a second infection of the black spot, and the fungus appeared on apples and pears during December and January, although previously quite clean. This sudden appearance, as it seemed to the fruit-grower, was easily accounted for by the unusual weather conditions prevailing at that time—plenty of moisture and thunderstorms between the showers supplying the best possible conditions for the development of the fungus spores lying latent and ready to burst into activity, whenever the necessary heat and moisture were provided. The soft and succulent nature of the growth also favored the entrance into the tissues of the germ tubes of the fungus, and the result was, where proper spraying at the right season had not destroyed the germinating power of the spores or formed a protective coating to the young growth, that the crop of apples and pears was much reduced and seriously affected.

While visiting Pakenham district in January of this year, in order to observe the effects of this late development on different varieties, I found how peculiar the weather had been. During December 4·23 inches of rain fell, occurring on 11 days, so that it was both excessive and continuous, and in the first three weeks of January 2·47 inches were recorded, falling on six days. This constant drizzle, with thunderstorms between, gave the fungus a fresh opportunity of which it was not slow to take advantage. These exceptional conditions, combined with the late attack and the susceptible character of the fruit, gave rise to various complications which puzzled even experienced orchardists. Thus, in some apples the bitter pit and black spot appeared together, producing large black depressed blotches which rendered the fruit unsightly. A similar development has taken place in previous years, but it was not so general or so noticeable as the recent one.

Red Spot Associated with the Black.

Associated with the black spot, in many orchards, there were red spots on the apples, and this, coupled with the late appearance of the spot, caused many to imagine that a new disease had appeared. But a little close observation would have shown them that the same appearance may be met with on otherwise healthy apples, and these spots are specially noticeable on the Stone Pippin and yellow-skinned varieties. If a small portion of the skin so affected is examined under the micsoscope, it is seen that the cells in the centre of these red spots are ruptured and disorganised. This minute cracking of the skin has very probably been caused by the excessive moisture, and the decay thus set up in the cells gives them a ruddy hue. It is chiefly on the side exposed to the sun that these red spots occur, and the joint action of the sun and moisture will tend to produce the discoloration.

Hundreds of apples were examined with these red spots surrounding the black, and in every instance it was found that either the black spot fungus had produced a rupture or its presence had produced decay in the surrounding cells, hence the colour.

It was even suggested that this was the "pink rot," an attendant on apple scab in many American orchards, but a microscopic examination would at once have dispelled such an idea. Pink rot is associated with a definite fungus which is very common on decaying vegetable matter of all sorts, but no trace of this was found on the apples examined.

The Doncaster Experiments.

Mr. A. F. Thiele again kindly allowed his orchard to be used for experimental purposes. The same plot of Yates apples was sprayed as in previous years, and the spraying took place on 2nd October, just one day later than in 1902. When the spraying was done the trees were generally in bloom, and about three to five days prior to full bloom. A rapid inspection of the trees, while the work was in progress, showed that on every tree a large number of tufts of the fungus had already appeared on the young leaves enveloping the blossoms, as well as on the flower stalks and calyx. As many as 50 diseased leaves were counted on one tree, where they could be easily seen at the level of the eye, without reference to attacks on the fruit-stalks and calyx. Under the circumstances really good results were not expected, as it was considered the spraying was at least a week too late. Spraying in bloom is sometimes recommended, but there is a danger that, as in this case, by that time the first infections may have occurred, and the fungus tufts may be producing almost unlimited quantities of fresh spores capable of attacking the leaves and fruit, if weather conditions prove favorable. The best plan appears to be to spray just as the first few blossoms are opening.

The mixtures used had all been tried before, with the exception of Soda Bordeaux and the addition of a phosphate (sodium phosphate) to the Bordeaux mixture. Slight variations were also intro-

duced in the amounts of the ingredients added to the Bordeaux mixture in order to see the effects of the larger or smaller quantities, and the ingredients were always added to the bluestone solution.

In preparing Soda Bordeaux, 6 lbs. of bluestone and 1½ lbs. of caustic soda were mixed and dissolved, then 1 lb. of lime was treated in the usual way and the mixture made as for ordinary Bordeaux.

The crop was gathered on 28th April, and it will be seen from the returns that the season was an "off" one for fruit, and this, of course, causes the distinction between the different sprays to be less marked.

There were five plots in which all the fruit was marketable, viz., Bordeaux + sal ammoniac, Bordeaux + sulphate of ammonia, Bordeaux + Paris green, and Copper-soda of two different strengths. Soda Bordeaux came next with a percentage of 98 of marketable fruit, while the unsprayed plot only yielded 32 per cent. of marketable fruit.

But the true test of the efficacy of a spraying mixture lies in the percentage of absolutely clean fruit that is produced, and it will be seen from the table that Copper-soda, 6·7·50, heads the list in this respect with 51 per cent., and the next is Bordeaux + 1 lb. sal ammoniac with 48 per cent.

Of the two strengths of ordinary Bordeaux mixtures tried, that of the formula 6·4·40 was the best, yielding 97 per cent. of marketable fruit and 42 per cent absolutely clean. This is the formula which Mr. Thiele himself uses for the general spraying of the orchard.

TABLE I.—RESULTS OF SPRAYING AT DONCASTER.

Plot.	Treatment.	Marketable.			Unmarketable.	Gross yield	Per cent. Marketable.	Per cent. Absolutely clean.
		Absolutely clean.	Slightly spotted.	Total.				
		lbs.	lbs.	lbs.	lbs.	lbs.		
1	Bordeaux, 6·4·50 ..	27	120	147	26	173	85	16
2	Bordeaux, 6·4·40 ..	49	63	112	4	116	97	42
3	Bordeaux, 6·4·50 + 2lbs. Salt	51	107	158	15½	173½	91	29
4	Bordeaux + 1lb. Sal ammoniac	39½	42½	82	0	82	100	48
5	Bordeaux + 2lbs. Sulphate of Ammonia ..	9¾	26	35¾	0	35¾	100	27
6	Bordeaux + ½lb. Sodium Phosphate	133	239	372	20½	392½	95	34
7	Bordeaux + ¼lb. Paris Green	76	88	164	0	164	100	46
8	Bordeaux + ½lb. Bichromate of Potash ..	126	243½	369½	14	383½	96	33
9	Soda Bordeaux 6·1½·1·50	64	135	199	5	204	98	31
10	Not Sprayed	4	16	20	42	62	32	6
11	Copper-Soda 6·9·50 ..	63	84	147	0	147	100	43
12	Copper-Soda 6·7·50 ..	42	41	83	0	83	100	51

Comparison with Previous Years.

There is a want of continuity in the experiments carried out owing to the fact that there is no experimental orchard available, where tests could be planned extending over a series of years, but I am indebted to the courtesy of various orchardists who take sufficient interest in the work to allow me a few trees for the purpose. Nevertheless I am able to give a few comparative figures for the past three seasons relating to Bordeaux mixture, and the addition of various ingredients which will show how far they have been successful during that period. It must be borne in mind, however, that, situated as we are, it is not usually possible to choose the best time for spraying, because we have firstly to study the convenience of the orchardist who gratuitously offers his services, and secondly we are not able to have the trees under constant observation prior to spraying. This being the case any intelligent orchardist should be able to secure better returns from the sprays we use than were obtained in these experiments.

TABLE II.—COMPARATIVE RESULTS OF SPRAYING.

Treatment.		Doncaster. 1903-04.	Doncaster. 1902-03.	Doncaster. 1901-02.	Pakenham. 1901-02.
Bordeaux 6·4·50	Absolutely clean	16 %	90·4 %	33 %	57 %
	Marketable ..	85 %	100 %	98½ %	100 %
Bordeaux 6·4·50 + salt (1, 2 and 3 lbs.)	Absolutely clean	29 %	90·6 %	—	67 %
	Marketable ..	91 %	100 %	—	100 %
		2lbs.	1lb.		3lbs.
Bordeaux 6·4·50 + 1lb. sal ammoniac	Absolutely clean	48 %	89 %	—	—
	Marketable	100 %	100 %		
Bordeaux 6·4.40	Absolutely clean	42 %	—	—	—
	Marketable	100 %			
Copper-soda 6·9·50	Absolutely clean	43 %	82 %	—	—
	Marketable	100 %	100 %		
Copper-soda 6·7·50	Absolutely clean	51 %	—	—	—
	Marketable	100 %			
Copper-soda 6·6·50	Absolutely clean	—	—	—	48 %
	Marketable ..	—	—	—	100 %
Unsprayed ...	Absolutely clean	6 %	10 %	0	0
	Marketable ..	32 %	100 %	55 %	50 %

As far as conclusions can be drawn from these figures the addition of salt seems to increase the effectiveness of the Bordeaux, at least in giving a greater proportion of absolutely clean fruit, and the same may be said of the addition of sal ammoniac. The returns from 1 lb. sal ammoniac added to the 6·4·50 Bordeaux are so much better than the 6·4·50 alone, that the effect of 1 lb. sal ammoniac added to 6·4·40 Bordeaux will be tried in the coming season.*

Copper-soda has turned out well, even with the excessive rainfall. It will be observed that there is a considerable amount of variability in the percentage of absolutely clean fruit in the different seasons even with the same spraying mixture, ranging from 16 to 90 per cent. This largely depends on the nature of the season, and the time at

*The 6·4·50 American formula is practically the same as our 6·4·40, the American gallon being smaller than the British,

which the spray is applied, for the black spot fungus may get a start if the spraying is delayed, and leave its mark afterwards on some of the fruit. In every season there is very little absolutely clean fruit on unsprayed trees in the Southern districts. In the season just passed the spot was very prevalent on the trees when spraying was done, October 2nd, though in the previous season none was observed on October 1st. Again in the season 1902-3 there was very much less spot altogether, and practically all the fruit was marketable.

Spraying Results at Burwood and Highett.

Notwithstanding the unfavorable season, and the late development of spot, there were numerous instances where thorough and timely spraying was attended with success. The cry was raised by many that the Bordeaux mixture failed in its effect when it was put to such a severe test as the past season afforded, but without going further afield than the neighbourhood of Melbourne, there were plenty of orchards where sound and clean fruit, as the result of spraying, disproved the statement. The photographs will give a better idea than any description of the state of the trees in some of these orchards, and an unsprayed tree grown in the same district will show by comparison the value of spraying.

It is constantly being repeated by growers who will not take the trouble to spray, or at least to do it thoroughly, that they cannot keep their fruit free from spot, but in the face of these illustrations and the testimony of the growers themselves, such a parrot cry can no longer be maintained.

The unsprayed trees of the same variety and in the same orchards with their badly affected fruit, in most cases not worth picking, and the sprayed trees with abundance of clean fruit, which had improved keeping qualities, bear eloquent testimony to the profitableness of the practice.

The Cleopatra or New York Pippin shown in the accompanying plate was grown at Mr. Keir's orchard, Highett. It is generally considered in this district undoubtedly the worst variety for black spot, so much so that most of the trees were cut down as not worth growing on that account. But a few were saved, and among those sprayed the grower reckoned that all the fruit was marketable. The Stone Pippin also showed abundance of clean fruit, and the grower informed me that there was not a single sound apple on this tree the previous season. The trees are about 20 years old, and the soil in this district is generally sandy, with a clay subsoil in some cases. They were sprayed twice with Bordeaux mixture of the 6·4·50 formula and 2 lbs. of salt added. The first spraying took place when the buds burst, and this was considered the most important; and the second when the fruit had set.

The orchard was first visited in the middle of February, and on revisiting it, I found that the Cleopatra was commercially clean as

far as the black spot was concerned, but there was a development of bitter pit, and from the Stone Pippin, rather a small tree, six cases of absolutely clean fruit were obtained.

The unsprayed Stone Pippin had shed most of its fruit and none of it was of any value owing to black spot.

But perhaps the most instructive display was at Mr. Vear's orchard, Burwood.

The Scarlet Nonpareil shown was literally loaded with fruit, and the 27 cases obtained from it were all marketable. After careful examination in February only a single spotted apple was found on it at the end of a branch, and when the fruit was gathered Mr. Vear wrote: "I saw one little bunch of apples with signs of spot, otherwise every fruit was perfectly clean."

A tree of American Red Streak yielded 16 cases, although a number fell off prior to picking, and no sign of spot could be detected upon them.

This orchard was all under-drained, and that would partly account for the luxuriant growth, but it did not account for the commercially clean fruit on the sprayed trees, and trees alongside of the same variety unsprayed, badly affected with both the early and late spot. The trees were from 26 to 27 years old, and, although the spraying was generally done twice, there was abundant evidence to show that a single thorough spraying prevented the late development of the spot. None of the trees were sprayed after the fruit had set, but the first spraying was done when the first blossoms had appeared and some very nearly in full bloom, and the second within a week afterwards. The ordinary Bordeaux mixture was used with the addition of salt.

The Bosc pear was also thoroughly sprayed and the fruit quite clean, but it was instructive to note that one tree somewhat isolated from the others, and not so thoroughly treated, showed the late spot.

At Mr. Nicholson's orchard, in the same district, the good effects of spraying were seen and here the ordinary 6·4·50 formula of Bordeaux mixture was alone used, and applied about 20th September. From one average tree 180 lbs. of sound fruit were obtained, and 6 lbs. were affected with the black spot. Thus in this variety, which is particularly subject to spot, only about 3 per cent. was affected, even although only one spraying was given.

Summary.

The experience of orchardists and the experiments recorded give a final answer to the question as to the efficacy of spraying, and show that 100 per cent. of marketable fruit can be secured by this means, even in a season very favorable to disease.

The Bordeaux mixture alone may be used, and from the results obtained the 6·4·40 formula is to be preferred. The addition of salt, sal ammoniac, or sulphate of ammonia is believed to give greater

SCARLET NONPAREIL APPLE AT MR. VEAR'S, BURWOOD.—27 CASES. [R. S. Braim, Govt. Printer.

(Sprayed Twice.)

SCARLET NONPAREIL APPLE AT MR. VEAR'S, BURWOOD.—27 CASES. [R. S. Brain, Govt. Printer

adhesive power to the mixture, and usually gives good results, but taking the average of several seasons it does not appear that they very appreciably increase the effect of the ordinary Bordeaux mixture if it is properly made and thoroughly applied at the right time. Copper-soda has also turned out well, and taking the proportion of absolutely clean fruit as a basis, the 6·7·50 formula is the best. The past season has likewise shown that the proper time to begin spraying is just when the buds are bursting and beginning to show colour, and before the spores have had time to germinate and penetrate the young leaves and calyx.

In an average summer the spores produced by the few fungus tufts occurring on a tree properly sprayed once at the right time, have practically no opportunity of germinating and attacking the fruit. On the other hand, in a wet summer these few tufts continue throughout the season to furnish fresh spores for infection, and at every favorable period additional fruit and leaves are attacked, hence two sprayings afford better insurance against loss than one. If, however, the one spraying could be applied at the very best time and no part of the tree missed, conditions almost unattainable in ordinary practice, the one might be as good as two even in the wettest year.

Where diseases such as black spot are prevalent, the seasons are too variable for the orchardist to risk the failure of his crop for want of spraying, and now that the remedy has been so thoroughly tried and efficiently proved, systematic spraying should be the rule in every orchard.

THE ORCHARD.

By Jas. Lang.

Planting and Pruning.

Planting and pruning operations will be the principal work for July and August, and the former should be finished as early as possible. The land is now in good condition; after a rather dry autumn sufficient rain has fallen to facilitate planting operations. A list of the best kinds of the different fruits to plant was given in the July, 1903, number of the *Journal.*

Pruning should be taken in hand as early as possible this month and pushed on until finished. In pruning old fruit trees always remember that the fruit spurs want regulating by thinning and cutting back quite as much as thinning out the young wood. In our climate, especially in the dry districts, there is always a tendency on the part of fruit trees to form more fruit spurs than is necessary, consequently if they are not properly thinned out the tree carries more fruit than it can properly mature, and it is therefore small and almost unmarketable, so that a judicious thinning out becomes a necessity if really good fruit is wanted. In pruning young trees avoid the fault of leaving too many main branches and thus prevent overcrowding. In cutting back the leading shoots it is a useful rule to take off about two-thirds of the young growth, leaving about one-third on the tree. As a general thing this will be pretty near the mark, though weak growing trees may be shortened back a little more, while strong growing trees may be left a little longer.

Towards the end of August is a good time to plant strawberry beds; the plants start to grow at once, and less labour is needed in keeping them free from weeds than if planted earlier.

The Export Season.

The export season has been a disappointing one, prices on the whole having ruled low all through the season. The London agents also complain of the poor quality of the fruit. Mr. J. B. Thomas, Covent Garden, writes:—"There is no doubt that this season's fruit from your colonies is generally lacking in quality and keeping condition." This, with the unusually large quantities of American apples held over in cool storage, and the early spring experienced in England and the Continent, bringing strawberries and cherries into the market much earlier than usual, accounts in a great measure for the low prices returned. At the same time such varieties as Munroe's Favorite, Cleopatra, Jonathan, Dumelow's Seedling, and Newtown Pippin have realised very remunerative prices. Account sales for Newtown Pippins ex "Ortona" gave an average of 14s. per case for the whole consignment.

GARDEN NOTES.

By J. Cronin.

Flower Garden.

Owing to the abnormally dry and warm weather conditions that prevailed during March and April, causing in many garden subjects an extended season of growth and consequent unusual softness of wood, a portion of the work usually performed during June could not be proceeded with.

This applied especially to pruning and planting, and no time should now be lost in overtaking such arrears.

During the autumn, many strong growing varieties of roses, especially teas and hybrid teas, have pushed out strong shoots from the old wood, in many cases from wood several years of age. These shoots are often sacrificed under the impression that they will neither ripen sufficiently to produce good blooms, nor eventually form well shaped and properly balanced heads. This idea is incorrect, as it is from such shoots properly managed that the best results are obtained. These shoots are simply fresh channels through which the sap flows freely, the cause of their appearance usually being the hardening of the bark in the smaller shoots, and the checks produced by previous prunings and breaks preventing an easy passage for the sap and extension of the head of the plant.

All weak and old wood should be entirely cut away, and the strong growths that are in a good position allowed to remain and slightly stopped. This topping will produce bud development well down the shoots, to which buds the shoots may be cut later before growth properly commences.

Weakly growing plants generally require to be pruned much more closely than those of stronger growth and to be well thinned also, care being taken to preserve a well balanced head.

The planting of deciduous trees, plants and shrubs should be hastened, so that they may be set and established before growth commences in spring, and where the roots have been damaged in the lifting the plant must be cut back well to insure vigorous growth.

Manuring and digging beds and borders should be hurried on, and beds prepared where special subjects are to be grown. Roses, chrysanthemums, dahlias, carnations, etc., to produce the best results apart from general border decoration, should each be grown separately in beds, as at certain times special attention is needed as watering, or withholding water to produce ripened growths, feeding, etc., as well as specially prepared soil and manures.

All manures should be thoroughly mixed through the whole of the soil and of an even depth, and not be, as is often the case, dug in in heaps at the base of, and in contact with, the stem and roots of the plant.

Seeds of most of the spring and summer flowering annuals and biennials should be sown, tender kinds likely to be damaged by frost being kept back until such danger is past.

Shelter from wind is a most important point in either flower or vegetable gardening, quantities of young plants being often practically ruined by one wind storm, and the work of months nullified. This can be prevented in a great measure at least, and I know of no better subject to plant for such purpose than the tree lucerne *(Cytisus proliferus)*. It is very rapid in growth, easily cut, and easily disposed of when cut, and does not exhaust the surrounding soil as most other hedge plants do. There are numerous splendid hedges of this plant in the Moorabbin district where fine vegetables are usually to be seen at the end of summer, growing within a yard of a hedge about 8 feet high and 3 feet through.

The use of this plant as a break wind has quite altered the value of some portions of the Brighton district, land heretofore windswept and bare in spring now being profitable for garden purposes. Tree lucerne resists drought and frost, but will not thrive in low wet situations. Seeds may be sown now; they should be soaked in hot water before sowing.

Kitchen Garden.

Sowing seeds for spring and summer supply of most vegetables, and planting out from former sowings, constitute the principal work during July and August. Peas, bean, carrot, parsnip, turnip, onion, cauliflower, cabbage, and other seed, should be sown according to needs. Succession should be provided.

In sowing carrot, parsnip, and turnip seed in rows it is a good plan to mix with each some radish seed. The radishes are through the ground in a few days, marking the rows distinctly, and when hoeing to keep down weeds there is less danger of running the hoe through or disturbing the slower germinating plants.

Where a hot-bed frame is available, seeds of tomatoes, melons of sorts, and cucumbers, may be sown in July for early use. Towards the end of August such seed may be sown in warm situations in the garden. Bush marrows are specially suitable for small gardens, requiring comparatively little room and fruiting early and continuously.

Earliana, a new tomato, is one of the earliest to ripen, and is a prolific bearer. I saw plants of this variety carrying good crops of ripe fruit at Leongatha last year before Christmas. They were raised on a hot-bed in July.

Several nurserymen raise quantities of tomato plants in heated houses early in the season, and where only a few plants are needed

they may be procured cheaply, without the trouble and expense of making a hot-bed. Large Red is the kind usually grown in market gardens, and in many places the original variety has been greatly improved by selection. There is no better market tomato, it being hardy and a great bearer.

There is usually room in the kitchen garden, on a fence or trellis, for a few plants of climbing habit. The Loganberry, a recently introduced cross between the raspberry and blackberry, is well worth growing in such positions. It is the earliest berry grown, large in size, good for dessert and cooking, and does not produce sucker shoots as do blackberries and others of the genus.

GRAIN MANURING EXPERIMENTS IN THE NORTHERN AREAS.

By F. J. Howell, Ph. D.

The very numerous experimental manure fields established throughout the whole of the Northern wheat growing area, during the years 1899-1902, appeared to give conclusive answers to the most important questions of fertilization concerning that portion of Victoria, and left little to be attempted in that part in the solution of manurial problems of immediate concern. It however appeared desirable to be in a position to anticipate possible future requirements, and to secure indications of the possible effect of the continuous exclusive use of phosphatic manures over long periods of time. With this object in view, as well as with the idea of gaining an insight into the effect produced by different systems of cultivation, a number of large experimental fields was established prior to the departure of my predecessor on various farms in the North. In only two cases, out of six originally established, have the experiments been continued up to the present time. Although it is yet early to make comparisons between results obtained from the different systems of cropping and cultivation, a few important facts are evident in the returns already obtained, and it appears desirable to give these publicity now. It must be recognised that such tests, conducted on the same plots for 10 or 15 years, would afford information of incalculable value to the Northern wheat grower. The arrangement with the farmer terminates at the end of six years, and a renewal of the term for a like period is certainly advisable. The nature of the tests will be understood, by reference to the accompanying plan and the returns already obtained are given below.

RETURNS FROM LARGE EXPERIMENTAL FIELDS.—NORTHERN AREAS.

Wheat Crop.	A. McPherson, Wycheproof			J. S. Mortimer, Katunga.			F. A. Cronk, Pine Lodge.	
	1901	1902	1903	1901	1902	1903	1902	1903
	Bushels per Acre.			Bushels per Acre.			Bushels per Acre.	
Plot								
1 ..	8·30	1·70	23·65	20·00	2·42	24·55	4·10	21·40
2 ..	5·45	·80	17·50	13·50	2·15	22·80	3·62	15·40
3 ..	8·65	1·50	27·50	18·22	3·17	23·35	4·72	23·05
4 ..	7·40	1·05	23·50	17·95	1·75	19·30	4·00	21·90
5 ..	5·95	·70	18·75	15·55	1·72	19·95	3·67	15·05
6 ..	7·75	1·50	27·75	18·60	3·45	25·30	4·57	30·15
7 ..	10·90	FALLOWED	24·20	20·30	FALLOWED	29·65	FALLOWED	25·60
8 ..	6·45		18·35	16·02		25·95		18·39
9 ..	10·25		28·80	20·32		30·70		27·95
10 ..	9·45		25·40	19·02		27·65		23·50
11 ..	6·95		19·40	14·70		26·20		18·39
12 ..	9·90		27·40	19·50		30·66		26·30

THE RESULTS DISCUSSED.

A comparison of the yields obtained in 1903 on the plots continuously cropped, with those obtained from the plots where a year's bare fallow has intervened, will reveal the increases due to the latter

About 726 feet = 11 Chains

		BORDER PLOT	
Cropped Continuously for 6 Years	Plot 1	50 lbs. Ordinary Superphosphate	
	2	No Manure	
	3	75 lbs. Ordinary Superphosphate	
	4	56 lbs. Thomas Phosphate	
	5	No Manure	
	6	50 lbs Ordinary Superphosphate, and 48 lbs Sulphate of Ammonia	
		BORDER PLOT	
		BORDER PLOT	
Cropped and Fallowed in Alternate Years	7	50 lbs Ordinary Superphosphate	Early Fallow and Frequent Cultivation
	8	No Manure	
	9	75 lbs Ordinary Superphosphate	
	10	56 lbs Thomas Phosphate	
	11	No Manure	
	12	50 lbs Ordinary Superphosphate, and 48 lbs Sulphate of Ammonia	
	13	No Manure	Late Fallow and Frequent Cultivation
	14	50 lbs Ordinary Superphosphate	
	15	No Manure	Early Fallow but no Cultivation
	16	50 lbs Ordinary Superphosphate	
	17	No Manure	Early Fallow and Frequent Cultivation
	18	50 lbs Ordinary Superphosphate	
	19	No Manure	Early Fallow, Deep Stirring, and Frequent Cultivation
	20	50 lbs Ordinary Superphosphate	
	21	No Manure	Early Fallow, Frequent Cultivation, and Horse hoeing the crop
	22	50 lbs Ordinary Superphosphate	
	23	No Manure	Early Fallow, Frequent Cultivation
	24	50 lbs Ordinary Superphosphate	
		BORDER PLOT	
		BORDER PLOT	
Cropped, Grazed, Fallowed in Successive Years	25	50 lbs Ordinary Superphosphate	Early Fallow, Frequent Cultivation
	26	No Manure	
	27	56 lbs Thomas Phosphate	
		BORDER PLOTS	

About 500 Feet = 9 Chains

The plots are about 20 feet wide by 720 feet long, being about 1/3 acre each. The whole field is about 10 acres, or a little more in area.

PLAN OF LARGE EXPERIMENTAL FIELD, NORTHERN AREAS.

system, and such a comparison ought, after some years, to indicate pretty clearly the system to be adopted with advantage by the farmer.

YIELDS OF WHEAT OBTAINED FROM MANURED PLOTS, 1903.

No of Plot on Plan.	Continuously Cropped				No. of Plot on Plan.	Fallowed in Alternate Years.				
	McPherson.	Mortimer.	Cronk.	Average of three fields.		McPherson.	Mortimer.	Cronk.	Average of three fields.	Gain in favor fallowing.
	Bushels.					Bushels.				
1 ..	23·65	24·55	21·40	23·20	7 ..	24·20	29·65	25·60	26·48	3·28
3 ..	27·50	23·35	23·05	24·63	9 ..	28·80	30·70	27·90	29·13	4·50
4 ..	23·50	19·30	21·90	21·56	10 ..	25·40	27·65	23·50	25·51	3·95
6 ..	27·75	25·30	30·15	27 73	12 ..	27·40	30·66	26·30	28·12	·39
	YIELDS OBTAINED FROM UNMANURED PLOTS.									
Average of Plots 2 & 5 ..	18·12	21·37	15·22	18·24	Average of Plots 8 & 11 ..	18·87	26·07	18·39	21·11	2·87

THE EFFECT OF FALLOWING.

The effect of fallowing appears evident, both from a comparison of the average returns from the unmanured plots under the two systems of cropping, as well as of the results obtained, in each instance, from the manured plots. The average yield of plots 2 and 5, in the continuously cropped portion of the 3 fields, works out at 18·24 bushels per acre compared with an average of 21·11 bushels obtained from the unmanured plots, 8 and 11, of the fallowed portion ; that is, fallowing alone appears to have resulted in an increased yield of 2·87 bushels. But the good effect of fallowing may be due to various causes. It may follow as the result of conservation of moisture, from the disintegration of mineral matter, from improved physical conditions, or from organic operative agencies working in the direction of the conversion of unavailable forms of nitrogen into available forms. With the magnificent rainfall of last season, it can hardly be thought that the larger yields of the fallowed plots were in any way largely due to a larger soil moisture content.

The special way in which fallowing appears to have worked, in the direction of the production of larger yields, becomes evident from a consideration of the following figures taken from the table above:—

AVERAGE YIELDS OF THE THREE FIELDS.

	Continuously Cropped.	Fallowed in alternate years.	In favor of Fallowing.
	Bushels.	Bushels.	Bushels.
50 lbs. superphosphate	23·20	26·48	3·28
75 lbs. superphosphate	24·63	29·13	4·50
56 lbs. Thomas phosphate	21·56	25·51	3·95
50 lbs. superphosphate .. .. } 48 lbs. sulphate of ammonia .. }	27·73	28·12	·39

It will be seen that in the first three instances, where phosphatic manures only have been used, there has been a very substantial gain

in favor of the fallowed plots. In the fourth instance, however, where a phosphatic and nitrogenous fertilizer has been applied, the yield on the continuously cropped plot is almost equal to that obtained from the fallowed plot, that is, the application of a nitrogenous fertilizer in the one case seems to have played the same effective rôle as fallowing has in the other. In a season similar to the one under review, the principal benefit to be derived from fallowing appears then to centre in the greater amount of available nitrogen provided for the crop's needs. This fact appears to be brought prominently forward by a comparison of the following figures :—

AVERAGE YIELD OF THE THREE FIELDS, 1903.

		Continuously Cropped.		Fallowed in alternate years.
		Bushels.		Bushels.
Plot 1 ..	50 lbs. superhosphate only	23·20	Plot 7 ..	26·48
Plot 6 ..	50 lbs. superphosphate .. 48 lbs. sulphate of ammonia	27·73	Plot 12 ..	28·12
	Gain due to sulphate of ammonia ..	4·53		1·64

From the figures above, applications of a nitrogenous fertilizer appear to have resulted in far heavier gains on the continuously cropped plot than on the fallowed, the increased yield produced being $4\frac{1}{2}$ bushels in the first case, compared with $1\frac{3}{4}$ in the second. The results are of great interest, and may indicate the necessity in the future of considering nitrogen requirements, as well as phosphatic, in Northern soils. It is quite possible that the exceptional rainfall of the past year may have allowed an operative effect on the continuously cropped ground of a nitrogenous fertilizer, which, under ordinary circumstances, would not have been evident. It is however possible, and perhaps probable, that the nitrogen reserves of our soils may, under a system of continuous cropping with phosphatic manures, soon show signs of exhaustion. An indication of such a thing occurring would reveal itself first in the more marked action of nitrogenous fertilization on continuously cropped ground, and the fields with which we are now dealing are particularly valuable as offering means for gauging the gradual decline in the stock of nitrogenous plant food which might be taking place. This contingency has been referred to by me on a former occasion, and my remarks, appearing in the Annual Report of the Department of Agriculture for 1900-1, may be worth repeating. I there wrote :—

"THE NITROGEN QUESTION."

"Here, again, we have one of the most interesting problems in the manure question, and one that can be only properly probed by continuous tests over a number of years on the same field, as indicated above. Generally speaking, an addition of nitrogen to our crops in the North results in a very small or no increase in returns, and sometimes leads to a reduction in the yield. Such an experience is quite contrary to the European, as clearly brought out in the classical experiments of Lawes and Gilbert, and finds at least one explanation in

the more active nitrification in our soils, favoured by the difference in climatic conditions. It is a question, however, owing to the much larger crops we are at present able to secure by the application of a purely phosphatic manure, whether the nitrogenous matter of our soils will be sufficient to provide the nitrogen necessary for these larger crops over any lengthy period of time, or whether there will not be a gradual falling off in the yields owing to the exhaustion of this nitrogenous matter. Under our present system of taking a crop once in three years, and devoting the other two to grass and bare fallow, such a contingency is, I think, not probable. There is just the possibility, however, of farmers, owing to the increase obtained from the use of manures, giving up more largely the year of grass, or at least the bare fallow on which they formerly depended for this result, and adopting in places a system of continuous cropping. (The more extensive keeping of sheep will, of course, do away with this state of affairs). There is no doubt that in years of a good rainfall crops are obtainable from the stubble with phosphatic manures for successive years, as good, or almost as good, as those from the fallow; but should such a system of continuous cropping ever find favor, it will most probably have as its sequence the exhaustion of the soil nitrogen, and the gradual falling off in effective power of our phosphatic manures. Under the three-year system of crop, grass, and fallow, at present pretty general in our drier districts, such an exhaustion of nitrogen is, as I stated, a remote possibility. The average farmer is, perhaps, unaware that the trefoil, clovers, and other leguminous plants that find a place during the year of grass in the natural herbage of the portion of the farm he leaves out, perform a singular and valuable service for him by accumulating in a wonderful way large quantities of atmospheric nitrogen, and leaving them in the ground for the benefit of crops that follow. An examination of such facts will show that a year's results from an experimental field cannot give us all the information we require in this direction. Experiments must continue on the same field with the same manures over a long series of years, under the conditions of continuous cropping, cropping with an alternate year of fallow, and cropping with the two intervening years of pasture and bare fallow. The effect of a leguminous crop to take the place of the year of grass should also be tested."

The Effect of Subsoiling.

The various cultivation tests included in the experiments are not yet in a sufficiently advanced state to admit of discussion. The effect of subsoiling, however, notably in the field of Mr. McPherson, appeared sufficiently marked to justify some reference. Both in the appearance of the growing crop and the actual results obtained in weight of grain and straw, there appears evidence for concluding that a deeper cultivation in the more compact clay soils of the North will result in a considerable improvement in yields. In the case of Mr. Mortimer, the difference produced by subsoiling was not so pronounced, but the heavier yields on the subsoiled plots than on the adjoining check plots, not similarly treated, suggest that in his case also the deeper cultivation had resulted favourably.

The returns in the two cases were as follows :—

	Unmanured Plot not Subsoiled. Bushels.	Unmanured Plot Subsoiled Bushels.	Manured Plot not Subsoiled. Bushels.	Manured Plot Subsoiled. Bushels.
Mr. McPherson ..	12·20	16·00	20·10	23·75
Mr. Mortimer ..	25·00	26·55	29·80	30·25

The photograph illustrating the growth of the crop on a number of the plots, taken from sheaves sent to the laboratory by Mr. McPherson, indicate better than figures the differences obtaining. Mr. McPherson wrote in reference to the matter, "Plots 19 and 20, deep stirring, are a good deal ahead of the others. The difference is remarkable."

The Influence of the Season on the Year's Returns.

The results from the three fields which have just been discussed are of interest as being the first obtained in the North with the use of manures, during a year of heavy rainfall. The preceding years in which manure experiments had been conducted were characterised by long dry periods at critical stages in the life of the crop, and by a low total rainfall for the growing period. The copious and beautifully distributed rainfall of last season gave the first opportunity of proving the maximum crops obtainable from the use of fertilizers with a sufficiency of moisture at all stages of growth. A comparison of the returns of last year with those of the two preceding, on the farm of Mr. McPherson, will indicate the effect of rainfall on the yields obtainable. The returns in Plot 6 may be selected for comparison :—

	1901	1902	1903
Yield of Wheat in Bushels	7·75	1·50	27·75

The rainfall for the three years on this farm was as follows :—

	1901. Inches.	1902. Inches.	1903. Inches.
January	·53	·46	·10
February	·38	·10	·31
March	·25	1·36	1·48
April	1·06	·05	2·55
May	·20	·35	·85
June	2·02	1·21	1·60
July	1·31	·24	2·65
August	1·34	1·08	1·49
September	1·81	·52	2·68
October	·94	·89	1·95
November	·19	·37	2·80
December	—	–	·55
Total	10·03	6·63	19·01

The heavy yields obtained last year from Mr. McPherson's are by no means exceptional, for the returns from the same plots of both Messrs. Mortimer and Cronk are correspondingly heavy.

	1903.
Mr. Mortimer	25·30 bushels.
Mr Cronk	30·15 bushels.

A frequent recurrence of the extremely favourable conditions of last season cannot be expected, but the returns under such conditions

1 2 3

EFFECT OF SUBSOILING

(1) Ordinary ploughing, no manure. (2) Subsoiled, no manure.
(3) Subsoiled and manured.

are of value as suggesting to the farmer the possibilities of his soil, and the vast importance of so regulating his methods of cultivation as to capture and conserve as much as possible of the limited rainfall usually at his service.

Further Tests in Northern Areas.

In addition to the continuous tests of the large fields just dealt with, a number of small plots was established during the season on a few other farms of the North. The returns confirm, in various directions, results obtained during previous years and offer evidence also of the modifying influence of a favourable season on the effect produced by the various manures.

The tabulated return presents the results of five fields.

RESULTS OF MANURE EXPERIMENTS ON SMALL FIELDS.

Northern Areas (1903-4.)

Tungamah Returns.															
Manures given per Acre.	51 lbs. ordinary Superphosphate	No Manure	56 lbs. Thomas Phosphate	76½ lbs. ordinary Superphosphate	No Manure	102 lbs. ordinary Superphosphate	51 lbs. ordinary Superphosphate 48 lbs. Sulphate Ammonia	No Manure	51 lbs. ordinary Superphosphate 48 lbs. Sulphate Ammonia Applied as top dressing in Spring	51 lbs. ordinary Superphosphate 59 lbs. Nitrate of Soda	No Manure	51 lbs. ordinary Superphosphate 56 lbs. Gypsum	51 lbs. ordinary Superphosphate Crop harrowed in Spring	No Manure	No Manure, but Crop harrowed in Spring
Plot ..	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
W. McDonald, Tungamah ..	23·91	19·00	24·66	27·33	15·50	27·66	25·66	17·66	25·00	23·83	18·16	25·66	24·50	18·25	12·16
J. Lee	29·66	24·66	27·66	30·33	21·66	28·66	30·50	23·83	28·83	27·50	25·00	28·83	29·66	24·50	23·66
J. Dickie	27·16	19·83	25·00	29·50	19·66	28·66	29·50	20·00	28·16	27·16	20·83	26·83	24·83	19·83	20·16
O. Kane	25·00	19·66	25·50	30·33	20·33	27·83	25·50	19·00	24·66	21·00	16·50	23·16	22·33	18·66	18·83
T. H. Leach, Youarang ..	18·66	11·66	18·50	23·55	11·50	24·00	17·66	10·66	19·33	20·50	10·83	19·33	18·83	10·50	10.33
Average of the five Fields (bushels)	24·87	18·96	24·26	28·20	17·73	27·36	25·76	18·23	25·19	23·99	18·26	24·76	24·03	18·34	18·24
Gain due to manures (in bushels)	5·91		5·30	10·47		9·63	7·53		6·96	5·73		6·50	5·69		·10 loss

Results Compared with those of Former Years.

The returns, like those of the larger fields just dealt with, are of special value as offering means for comparison between results obtained during a wet season and those secured under a scanty rainfall. This applies principally to the effects produced by phosphatic fertilizers. The increased yields, following the use of equal quantities of superphosphate and Thomas phosphate during the three years, were as follows :—

Increased Yields Resulting from

		51 lbs. Superphosphate per acre	56 lbs. Thomas Phosphate per acre.
		Bushels.	Bushels.
1900	Average of 85 fields	4·40	3·19
1901	Average of 94 fields	5·02	3·35
1903	Average of 5 fields	5·91	5·30

The fairness of comparing the average of a small number of fields as in the case of last year, with the large number of the two preceding years, might with justice be called in question; but even so the influence of an abundant rainfall can I think be accepted as evident, both in the larger increased yields resulting from equal quantities of superphosphate, and in the far greater relative effectiveness of Thomas phosphate, as shown in the above table. The larger rainfall of last year appears also to have allowed a more effective action on the part of heavier manurial applications. The increased yield on Plot 4, where 76½ lbs. of superphosphate have been applied, amounted to 10½ bushels nearly, while a practically equivalent quantity in the years 1900 and 1901 gave increased yields of 5·32 and 6·03 bushels only. It is, however, of interest to note that, even with the splendid rainfall of last year, quantities of a superphosphate, exceeding that used on Plot 4, appeared to produce no further increase in yield; the returns on Plot 6, where 102 lbs. have been used, showing even smaller figures than those of Plot 4, where the smaller quantity has been applied. The slightly increased yields on Plots 7 and 9, where nitrogen and phosphoric acid have been applied, over those of Plot 1, where an equal quantity of phosphoric acid has been given, may be regarded, I think, as confirmatory of results obtained in the larger fields with respect to a certain operative effect last season of a nitrogenous fertilizer.

Remaining Tests of Small Fields.

The remaining tests of the small fields included trials showing the effect of the addition of gypsum to the superphosphate, of harrowing the growing crop in the spring, and the application of manures in different ways. This last test was only carried out on two fields, and included an application of the fertilizer with the drill at the time of sowing the grain, a broadcast application after sowing, and an application ploughed in prior to sowing. The grain in all cases was put in with the drill. In the case of the gypsum tests, the yields, in three cases out of five, were heavier where gypsum had been added to the superphosphate than where it was omitted, but in the two remaining cases the reverse result followed. Taking the average of the five fields, the differences in favour of gypsum appeared too small to merit serious consideration. It will be noticed, on referring to the table,

that in the three cases where gypsum appears to have produced an effect, Thomas phosphate has either equalled or exceeded in its action an almost similar quantity of superphosphate, and it may perhaps be assumed that the small addition of lime, either in the carbonate or sulphate form, has been responsible for the increased yields.

With respect to the harrowing tests, this operation, taking the figures of the average, appeared to produce no good effect, a result, considering the season, creating no surprise.

The tests to determine the best method of applying the fertilizer appeared to largely favour the drill, as evident in the following returns:—

GAINS DUE TO 102 LBS. OF SUPERPHOSPHATE PER ACRE.

	Applied with Drill.	Broadcast Application.	Ploughed in.
	Bushels.	Bushels.	Bushels.
Average of two fields ..	9·75	6·00	6·11

THE RESIDUAL EFFECT OF MANURES.

The fact of the full profits, resulting from the use of phosphatic manures, not being contained in the first year's returns has already been demonstrated to the farmer by field tests conducted by this Branch. In these tests, the residual effects on a second year's crop have been determined and made known. It is, however, a little surprising to find that such small quantities as 10 and 20 lbs. of a superphosphate are capable of exercising so marked a residual effect after a period of four years from the first application. In the year 1900, a small field embracing 15 plots each 1-5th of an acre in area was put down on the farm of Mr. McPherson, of Wycheproof. In the following year the field was let out to grass, fallowed the next year, and then cropped the succeeding season without manure. The increased yields due to manures, both in the first and fourth years, are given in the following return. With the exception of one or two irregularities the effects appear consistent throughout.

RESULTS OF EXPERIMENTAL MANURE PLOTS AT THE FARM OF MR. A. MCPHERSON, WYCHEPROOF.

Plots 1-5th Acre in area.

No. of Plot.	Manures used per Acre	1900. Sown and Manured. Yield per Acre.	1901.	1902.	1903. Sown without Manure. Yield per Acre.
		Bushels.			Bushels.
1	10 lbs. concd. superphosphate ..	26·04	GRAZED.	FALLOWED.	16·75
2	No manure	23·92			15·25
3	20 lbs. concd. superphosphate ..	28·62			16·66
4	30 lbs. concd. superphosphate ..	28·87			16·66
5	No manure	24·33			15·83
6	50 lbs. ordinary superphosphate ..	28·96			16·75
7	56 lbs. Thomas phosphate	27·42			16·50
8	No manure	23·92			14·75
9	50 lbs. bonedust	26·17			14·16
10	10 lbs. concd. superphosphate 36 lbs. sulphate of ammonia	26·96			13·75
11	No manure	23·33			12·91
12	20 lbs. concd. superphosphate 72 lbs. sulphate ammonia	29·84			15·00
13	50 lbs. Maldon Island guano Partial superphosphates	27·54			16·25
14	No manure	23·50			15·50

The Northern Results Summarized.

The pronounced effect of phosphatic fertilizers is only confirmatory of the results of former experiments, but the whole of the present returns tend to show a considerably more marked effect from these fertilizers, under the ample moisture supply of last year, than under the prevailing drier conditions of preceding seasons. The limits, however, of an effective application, with an ample moisture supply, are lower in these returns than expected, and appear to be somewhat below, rather than above, 80 lbs. of superphosphate to the acre. The natural fertility of the soils under review, judging from the returns of the unmanured plots, may however be considered a high one, and on soils below this standard larger quantities would probably prove effective. The wet season appears to have specially favoured the effective action of Thomas phosphate. There appears further in the returns, evidence for concluding that Northern soils, which hitherto with few exceptions have remained passive to nitrogenous applications, may show, under an ample moisture supply, a response to such treatment, and indications are also present that continuous grain cropping, year after year, with phosphatic fertilizers may, after some years, lead to soil conditions in which the application of a nitrogenous manure, in addition to a phosphatic, may also become a necessity. It is with the data at present to hand a little early perhaps to draw such conclusions, but the easy possibility of such an occurrence demands attention. Such a contingency suggests the advisableness, where the three year course of crop, grass and bare fallow is not the practice, of occasionally intervening some leguminous winter crop, such as peas, the cost of which might be profitably covered by feeding off in spring. Such a practice has, in instances, been successfully carried out in the North. The returns appear also to show that the use of small quantities of gypsum mixed with the superphosphate may prove of some slight value on certain soils of the North, deficient possibly in lime or of a mechanical condition tending to set the soil and interfere with the development of the plant in its earlier stages of growth. The few tests carried out on different methods of applying manures favor largely the application with the drill, equal quantities of superphosphate applied broadcast as a top dressing after sowing the grain, as well as ploughing in prior to sowing, showing considerably smaller yields than those obtained from the applications made with the drill.

GENERAL NOTES.

Bordeaux Powder for Dust Spraying.

Owing to the attention which has been lately directed to the possibility of using Bordeaux mixture in the dry form, it has been considered advisable to place before local growers what is probably the best form of making this powder. The process has been devised by R. M. Bird, Chemist to the Missouri Agricultural Experiment Station, U.S.A.

The materials required to make about seventy pounds of a stock powder, which can readily be made up to a strength equivalent to the ordinary 6·4·40 liquid Bordeaux, are as follows :—

Bluestone	6 lbs.
Quicklime	4 lbs.
Water to dissolve bluestone ...	2 gals.
Water to slake lime	2 gals.
Air slaked lime, sieved	60 lbs.

A box about 3 × 3 × 3 feet is required with which the material is sifted. A wire sieve with 25 or 30 meshes to the inch should be made to fit the top of the box, and should be provided with a cover to prevent the lime dust from escaping. Another sieve, but with 100 meshes to the inch, is also needed.

A wooden block made of a flat piece of 1 inch or 1½ inch stuff, about 12 inches square, with a handle at right angles to the surface of the flat piece of wood, will help to rub the material through the sieve.

Two closely woven *cotton* flour bags, one slipped inside the other, are needed to filter the blue material.

Directions for Making.

1. Break up into small lumps about 70 or 80 lbs. of quicklime, and spread it out so that it will become air slaked. When slaked and perfectly dry sift it through the fine sieve (100 meshes).

2. Dissolve 6 lbs. of bluestone in 2 gallons of water.

3. Slake 4 lbs. of good quicklime so as to get a fine powder, and make up to 2 gallons of milk of lime and allow to cool.

4. Put 60 pounds of the *sifted air slaked* lime into a shallow box, one in which the material can be thoroughly worked with a hoe or shovel.

5. Pour the well stirred milk of lime and the bluestone solution *at the same time* into a third vessel, and stir well till the whole is perfectly mixed, when it will have a deep blue colour and be thick.

6. Pour *immediately* into the double flour bag and squeeze out most of the water.

7. Empty *at once* (it must not be allowed to dry) this wet blue material into the 60 lbs. of air slaked lime and work it up so that it will be well distributed. If the resulting mixture is too moist add more air slaked lime.

8. Rub the mixture through the *coarse* sieve while *still somewhat damp,* mix thoroughly and spread out to dry.

9. When perfectly dry sift it through the *fine* sieve, crushing all lumps. All of this can be readily made to go through the sieve except the small amount of sand which may be in 4 lbs. of quicklime. Mix so that the blue copper compound will be perfectly evenly distributed throughout the whole mass.

This stock powder will keep indefinitely. For use add 130 lbs. of slaked lime (or an equal *volume* of flour) to the stock powder, and the resulting mixture will be practically of the same strength as the 6·4·40 Bordeaux. Paris green may be added in the usual proportion if required. It need hardly be said that a proper dust sprayer is needed for making the application.

Black Spot of the Vine.

The following method of treatment is recommended by the Vegetable Pathologist for black spot of the vine :—

WINTER WASH.

Sulphuric acid	1 lb.
Water	10 lbs. (1 gallon)

Add the acid to the water, using wooden vessels. This solution should be brushed over the parts of the vine above ground before any sign of growth is noticed. A mop of hog's bristles or horsehair is useful for applying this material, and care should be taken not to splash it over one's clothes or hands.

When acid is bought in quantity it is sometimes difficult to ascertain the weight of small quantities. The ordinary repnted quart wine or whisky bottle holds one-sixth of a gallon, that is three pounds of acid, so a convenient measure can be made from one of these bottles by marking it off into three equal parts each of which will represent the pound of acid to add to 1 gallon of water.

SPRAY FOR USE IN THE SPRING.

When the buds are beginning to expand the vines should in addition be sprayed with Bordeaux mixture, 6·4·40, if there is reason to suspect serious trouble, or if last season the disease was prevalent.

Bluestone	6 lbs.
Quicklime	4 lbs.
Water	40 gallons

Dissolve the bluestone in 20 gallons of water in a tub or cask, and slake the lime gradually so as to obtain a fine smooth paste free from lumps. Add 20 gallons water to the lime so as to make what

is called milk of lime, and then run both bluestone solution and milk of lime evenly together into another barrel or into a spray pump, using a strainer over it to keep out any lumps. Stir thoroughly and use same day.

Instead of the Bordeaux, Copper-soda may be used. It is made in the same way as Bordeaux except that the 4 lbs. of lime is replaced by 9 lbs of washing soda.

Bluestone	6 lbs.
Washing soda	9 lbs.
Water	40 gallons

Both the Bordeaux and the Copper-soda may be used for spraying trees as well as vines to prevent the attack of various fungus diseases. The quantity of water may in cases be increased to 50 gallons.

THE RAINFALL FOR THE FIRST QUARTER OF 1904.

The rainfall records for January show a very unusual excess over the average for nearly the whole of the State, the only exception being the basins of the Tambo and Snowy rivers, where a slight deficiency of 4 per cent. below average occurred.

In February a still more abnormal excess of rainfall was experienced over the whole of the southern half of the State, and all northern areas between the ranges and the Murray east of the Campaspe river, but in the north-western quarter of the State a deficiency of 20 per cent. was recorded.

Very little rain fell in the earlier part of March, and hardly any in the latter part. The totals for this month show a general deficiency of from 40 to 70 per cent.

RAINFALL TABLE for the First Quarter of the year 1904, showing averaged amount of rainfall in each of the 26 Basins or Regions, constituting the State of Victoria, for each month and for the first quarter, together with corresponding monthly and quarterly averages for each Basin, deduced from all available records to date.

Name of Basin.	1st Quarter.							
	January		Febr'ary		March		Total for 1st Quarter	Average for 1st Quarter
	Amount 1904	Average	Amount 1904	Average	Amount 1904	Average		
Glenelg and Wannon Rivers ..	2·38	1·44	1·82	0·62	0·62	1·32	4·82	3·38
Fitzroy, Eumerella & Merri Rivers	3·06	1·48	1·67	0·79	0·90	1·51	5·63	3·78
Hopkins River & Mt. Emu Creek ..	3·22	1·48	2·56	0·71	0·86	1·52	6·64	3·71
Mt. Elephant & Lake Corangamite	3·98	1·43	2·96	0·84	1·07	1·52	8·01	3·79
Otway Forest	4·30	1·62	4·11	0·99	1·28	2·14	9·69	4·75
Moorabool & Barwon Rivers ..	4·35	1·44	3·57	1·04	0·77	1·67	8·69	4·15
Werribee & Saltwater Rivers ..	4·34	1·48	3·80	1·36	0·70	1·95	8·84	4·79
Yarra River & Dandenong Creek ..	6·63	1·94	6·34	1·28	1·06	2·31	14·03	5·53
Koo-wee-rup Swamp	6·13	1·77	4·88	1·24	0·92	2·15	11·93	5·16
South Gippsland	5·20	2·04	3·91	1·67	0·88	2·32	9·99	6·03
Latrobe & Thomson Rivers ..	5·07	2·15	3·52	1·55	0·81	2·34	9·40	6·04
Macallister & Avon Rivers .	3·12	2·01	3·53	2·29	0·67	1·65	7·32	5·95
Mitchell River	2·85	2·23	4·42	2·52	0·58	1·95	7·85	6.70
Tambo & Nicholson Rivers ..	2·76	3·05	3·38	1·44	0·68	1·67	6·82	6·16
Snowy River	3·14	3·07	4·93	2·19	0·81	2·50	8·88	7·76
Murray River	3·56	1·37	0·86	1·29	0·38	1·84	4·80	4·50
Mitta Mitta & Kiewa Rivers ..	4·13	1·72	1·82	2·26	1·06	2·17	7·01	6·15
Ovens River	3·23	2·39	1·21	2·01	0·65	2·33	5·09	6·73
Goulburn River	4·48	1·47	1·22	1·06	0·41	1·68	6·11	4·21
Campaspe River	5·80	1·29	0·92	0·91	0·36	1·83	7·08	4·03
Loddon River	3·28	1·11	0·94	0·63	0·30	1·32	4·52	3·06
Avon & Richardson Rivers ..	2·10	0·90	1·16	0·41	0·46	0·95	3·72	2·26
Avoca River	2·49	0·85	0·93	0·28	0·39	1·19	3·81	2·32
Western Wimmera	1·40	1·02	0·92	0·32	0·48	0·88	2·80	2·22
Eastern Wimmera	2·30	1·16	1·66	0·36	0·29	1·20	4·25	2·72
Mallee Country	1·44	0·82	1·02	0·22	0·27	0·88	2·73	1·92
State	3·16	1·48	2·11	0·97	0·56	1·55	5·83	4·00

The totals for the first quarter of the year bring out an excess over the average for every part of Victoria, but varying considerably in actual amount. Thus the greatest rainfall occurred in the districts surrounding Port Phillip Bay, the South-Western Districts, South Gippsland, and the northern country east of the Campaspe river. In the remaining areas the excess was less, and least of all for the basins of the Tambo and Snowy rivers.

The distribution of rain during the first quarter was not, however, so satisfactory as the figures might at a first glance be assumed to indicate. The heavy rains of January and February came too early to be of much use for agricultural purposes and did some damage, and the dryness of March, the time when abundant rain is most necessary, retarded the preparation of the soil for sowing purposes, and probably interfered to a considerable extent with pastoral interests.

PERCENTAGE RAINFALL TABLE for the First Quarter of the year 1904, showing the percentage *above* or *below* the average rainfall for each month and for the first quarter in Victoria.

Regions.	January.		February.		March.		First Quarter.	
	Above average	Below average	Above average	Below average	Above average	Below average	Above average	Below average
	%	%	%	%	%	%	%	%
Western Districts	117	—	204	—	—	41	71	—
Cape Otway Forest	165	—	315	—	—	40	104	—
Counties surrounding Port Phillip Bay ..	224	—	278	—	—	57	122	—
South Gippsland	155	—	134	—	—	62	66	—
Basins of La Trobe, Macallister, and Mitchell Rivers	73	—	80	—	—	65	31	—
Basins of Tambo and Snowy Rivers ..	—	4	129	—	—	64	13	—
All Northern areas between the ranges and the Murray west of the Campaspe River	157	—	—	20	—	71	17	—
All Northern areas between the ranges and the Murray east of the Campaspe River	122	—	199	—	—	66	51	—
State	114	—	118	—	—	64	46	—

RAINFALL IN VICTORIA.

Months of April and May, 1904.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in April, 1904.	Average rainfall for each Area for the month of April based on all previous years of record.	Maximum fall recorded within each Area during April, 1904.	Actual Average rainfall recorded in each Area in May, 1904.	Average rainfall for each Area for the month of May, based on all previous years of record.	Maximum fall recorded within each Area during May, 1904.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	0·64	1·32	0·78 at Beulah	1·01	1·32	1·68 at Beulah
B	0·93	1·95	1·40 ,, Serviceton	2·13	1.93	2·78 ,, Serviceton
C	1·09	2·31	1·38 ,, Panmure	3·82	2·62	5·26 ,, Koroit and Panmure
D	1·36	2·89	1·75 ,, Portland	4·09	3·20	5·15 ,, Port Campbell
E	0·72	1·72	0·87 ,, Charlton	0·84	1·77	1·09 ,, Charlton
F	0·97	2·11	1·95 ,, Wangaratta	2·04	2·55	3·33 ,, Benalla
F^1	0·85	2·13	1·13 ,, Alexandra	2.24	2·93	3·10 ,, Alexandra
F_2	1·33	2·53	1·40 ,, Beechworth	3·13	3·69	3·84 ,, Yackandandah
G	0·83	2·17	1·13 ,, Yandoit	2·27	2·55	3·43 ,, Kyneton
H	1·20	2·72	1·43 ,, Daylesford	2·54	3·17	3·23 ,, Daylesford
I	0·62	2·49	0·81 ,, Ballan	2·23	2·29	3·11 ,, Werribee
I^1	1·06	2·99	1·32 ,, Dandenong	3·17	3·16	3·93 ,, Cape Schanck
K	1·33	3·43	2·19 ,, Wood's Point	3·46	3·91	5·74 ,, Bright
L	0·67	2·85	1·06 ,, Bairnsdale	2·43	2·06	4.00 ,, Orbost
M	—	3·35	1·10 ,, Gabo	—	4·14	3·46 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

EXPORTS DURING APRIL AND MAY, 1904 AND 1903.

Description of Produce.		April. 1904.	April. 1903.	May. 1904.	May. 1903.
Butter..	lbs.	2,404,684	839,476	986,124	935,768
Cheese	lbs.	72,300	60,120	77,760	77,580
Milk and Cream	cases	3,358	524	1,031	910
Ham and Bacon	lbs.	185,240	147,646	123,600	129,200
Eggs	dozen	800	360	1,500	700
Poultry	head	2,300	10,850	1,380	15,030
Rabbits and Hares ..	pairs	49,300	116,708	206,132	140,532
Mutton and Lamb ..	carcases	1,981	5,860	699	6,431
Beef	quarters	162	942	361	80
Pork	carcases	10	5	80	34
Veal	,,	322	343	145	388
Fruit	cases	11,899	34,575	2,287	19,163
Fruit Pulp	,,	505	525	494	629

ARRIVALS IN MELBOURNE OF BUTTER and Butter ex Cream in Tons net, by Rail and Steamer from the different districts for the last 13 months, as compared with the previous corresponding months.

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
May ..	794	670	137	95	14	13	354	421	289	141
June ..	595½	473	118	40	13½	22	213	247	251	164
July ..	461½	435½	108	54½	16½	17	179	190	260	174
August ..	641	468	163	99	33	24	122	122	323	223
September ..	1288	1042	323½	216	87½	63	317	267	560	496
October	2122	1607	439	360	174	92	697	567	812	788
November ..	2750	2049	622	430	201	94	943	787	984	738
December ..	2756	1995	528	358	194	83	1026	860	1008	694
	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.
January.. ..	2220	1985	403	362	150	66	917	870½	750	686½
February ..	2047	1383½	407	90½	170	51½	844	814	626	427½
March	2033	1371	316	112	156	27	938	740¾	623	491½
April	1167	910½	156	140	77	14½	580	443	354	313
May	930	794	119	137	29	14	466	354	316	289

R. CROWE.

DELIVERIES FROM THE GOVERNMENT COOL STORES, DURING APRIL AND MAY, 1904 AND 1903.

Description of Produce.		April. 1904.	April. 1903.	May. 1904.	May. 1903.
Butter..	lbs.	1,141,896	109,928	175,728	264,208
Cheese	,,	9,691	—	23,200	—
Milk and Cream (concd.) ..	cases	722	647	875	1,049
Eggs	dozen	7,608	23,300	11,342	21,390
Poultry	head	1,035	6,075	22,695	3,410
Rabbits and Hares ..	pairs	32,580	73,775	183,764	123,568
Mutton and Lamb ..	carcases	872	3,923	501	1,540
Veal	carcases	23	4	9	355
Pork	,,	—	—	69	—
Beef	quarters	88	—	20	56
Fruit	cases	2,259	2,106	54	360
Sundries	lbs.	11,118	—	20,292	4,208

R. CROWE

Fruit and Plants.

EXPORTS to Australian States and New Zealand, Inspected during April and May, 1904.

Fruit.	Cases or Packages Inspected.		Certificates Given.	
	April.	May.	April.	May.
Apples	2130	515	111	28
Bananas..	973	838	283	188
Cucumbers	3	—	1	—
Figs	14	11	5	2
Grapes	936	8	212	1
Lemons	148	221	55	79
Melons	10	25	3	7
Mixed Fruits	1	2	1	1
Nectarines	1	—	1	—
Oranges	85	315	38	123
Passion Fruit	57	33	39	40
Peaches	222	26	62	11
Pears	713	185	118	31
Persimmons	16	5	6	5
Pineapples	154	96	93	87
Plums	150	—	20	—
Quinces	104	84	25	11
Tomatoes	16	23	8	12
Plants	4	27	2	5
Bulbs	5	—	3	—
Totals	5,742	2,414	1,086	630

J. G. TURNER,
For C. French.

EXPORTS beyond the Australian Commonwealth and New Zealand, during April and May, 1904.

Destination.	Apples. Cases.	Pears. Cases	Totals.
United Kingdom	11643	330	11973
India	436	4	440
Belgium	200	—	200
British Columbia	157	—	157
Malay Peninsula	104	—	104
Java	100	—	100
South Africa	50	—	50
Totals	12,690	334	13,024

J. G. TURNER,
For C. French.

PUBLICATIONS ISSUED BY THE DEPARTMENT.

Bulletins.

Reprinted from the Journal.

No. 1. Impressions of Victoria from an Agricultural Point of View. By S. Williamson Wallace.
No. 2. Treatment of Vintage by Diffusion. By Pierre Andrieu (Translated from the French by R. Dubois and W. P. Wilkinson).
No. 3. *Black Spot of the Apple; together with Spraying for Fungus Diseases. By D. McAlpine. (New Edition in Preparation).
No. 4. *Review of the Past Butter Season. By R. Crowe.
No. 5. *Two Years' Field Work of the Chemical Branch. By F. J. Howell, Ph. D.
No. 6. Co-operative Forage Experiments in Southern Victoria. By F. J. Howell, Ph. D.
No. 7. Field Experiments of the Past Year by the Chemical Branch. By F. J. Howell, Ph. D.
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No. 13. Field Experiments in Manuring, 1903-4. By F. J. Howell, Ph. D.
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Guides to Growers.

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Report on the Preservation of Fruit for Shipment. By J. M Sinclair.
Report on Meat Inspection in the United States. By J. M. Sinclair.

The Butter Industry of Victoria and the British Export Trade. By J. M. Sinclair.
Prospectus and Regulations of the Agricultural College and the School of Horticulture, with Syllabus of Instruction.
Poultry Breeding and Management for the English Markets.
Report on Successful Farming in the Mallee. By F. J. Howell, Ph. D.
List of Butter and Cheese Factories in the State of Victoria.
The New Agriculture. By the Hon. I. A. Isaacs.
The Beet Sugar Industry in Victoria. By A. N. Pearson.
List of Exporters of Agricultural Products.
The Scientific Directing of a Country's Agriculture. By A. N. Pearson.
Additions to the Fungi on the Vine in Australia. By D. McAlpine.
Fungus Diseases of Cabbage and Cauliflower in Victoria, and their Treatment. By D. McAlpine, Government Vegetable Pathologist.
Chart for the Guidance of Dairymen. By R. Crowe, Dairy Expert.
Bacteriological Examination of Water at the Butter Factories. By H. W. Potts, F.C.S.
Report on Wheat Production in the United States, Canada, and the Argentine Republic; also the Handling and Shipment of Grain in the United States. By J. M. Sinclair.
Report of Conference on the Elevator System in the Handling and Shipment of Grain.
Annual Reports, 1899, 1900 and 1901.

Any of the above may be had Free, on application to the Secretary for Agriculture.

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Fungus Diseases of Citrus Trees in Australia. By D. McAlpine. Price 2s.
Fungus Diseases of Stone Fruit Trees in Australia. By D. McAlpine. 165 pp., 10 colored plates. Price 2s. 6d.
Australian Fungi. By Dr. Cooke. Price £1 1s.

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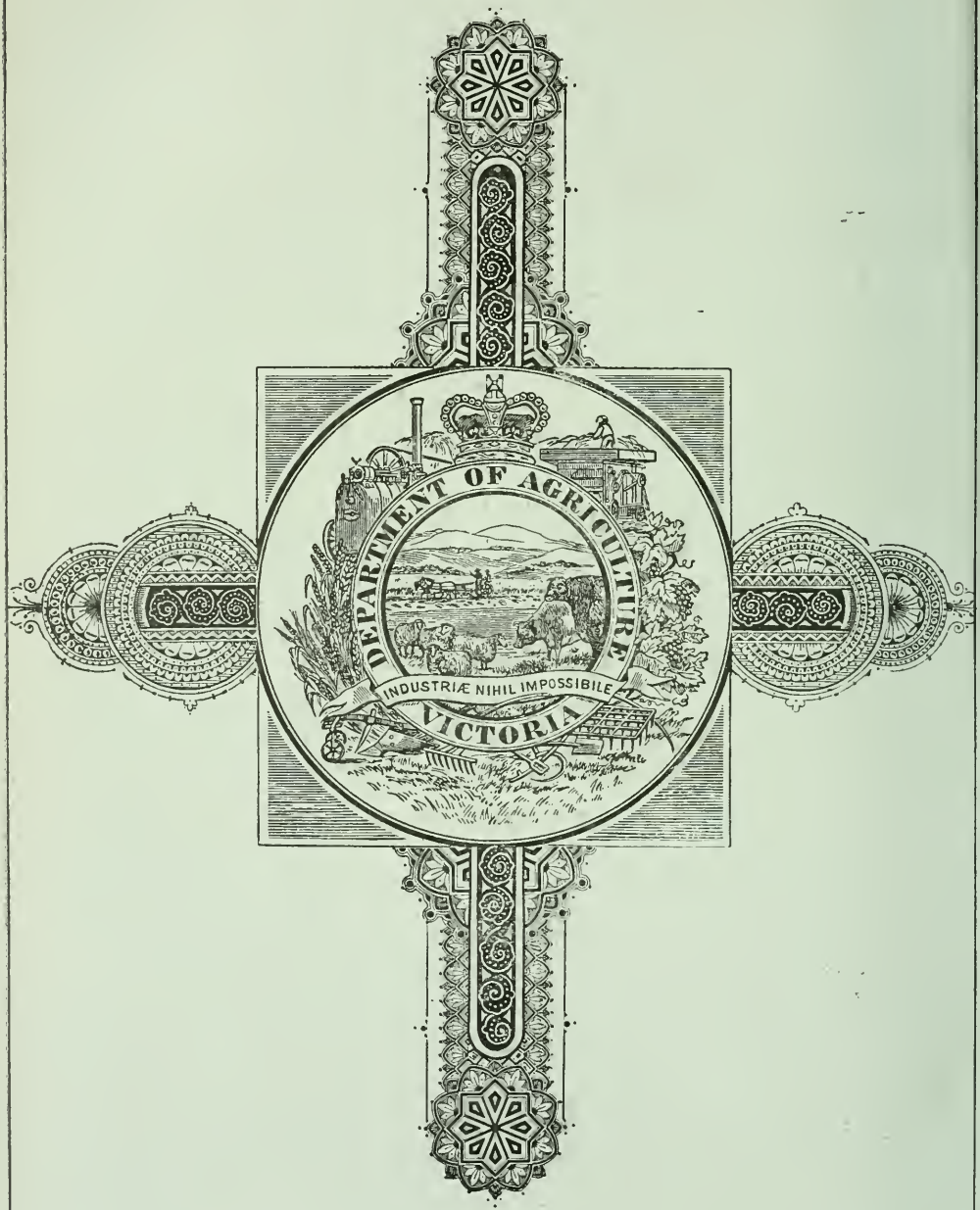
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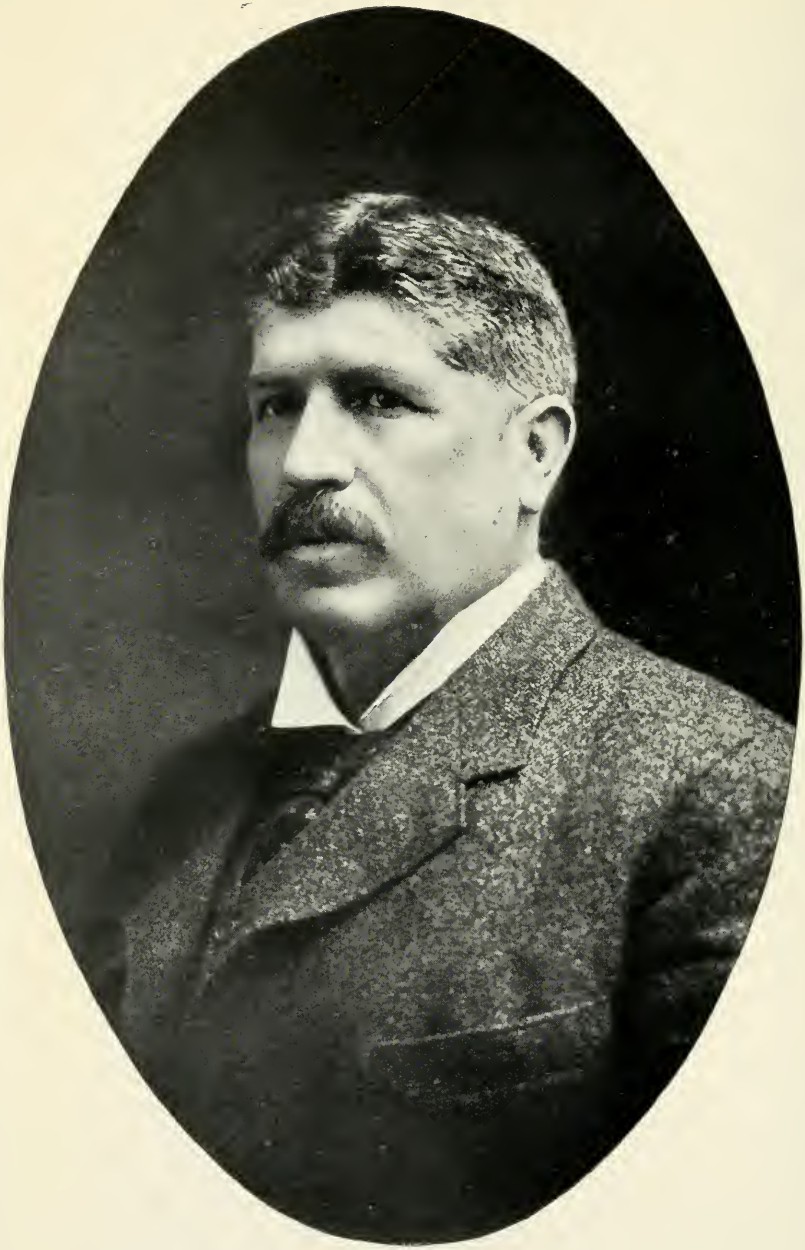

THE HON. J. MURRAY, M.L.A.,
MINISTER OF AGRICULTURE.

Vol II. Part 9. SEPTEMBER, 1904.

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S. WILLIAMSON WALLACE.
DIRECTOR OF AGRICULTURE.

E. G. DUFFUS.

ACTING SECRETARY FOR AGRICULTURE.

AGRICULTURAL JOURNAL OF VICTORIA.

SEPTEMBER, 1904.

A SURVEY OF THE WORK AND PROGRESS OF THE VICTORIAN AGRICULTURAL DEPARTMENT.

By S. Williamson Wallace, Director of Agriculture.

Introduction.

This Annual Report reviewing the work of the various branches of the Department, with the exception of the introductory portion, is practically the same as the address given by me at the Annual Conference of the Chamber of Agriculture. One of the main features of the year's work, it will be found, is the further development of the educational work established two years ago by myself. Farmers' classes have been a complete success, and if held in sufficient number will soon have a marked effect on agricultural methods in Victoria. Additional lecturers, well qualified to give instruction in wine making, cheese making, and in the poultry industry, have been engaged. This, I trust, will greatly aid these industries in the near future.

The experimental work of the Department is for the first time placed on a permanent footing. Experiments will be conducted on fields of from five to ten acres, and over a series of years, thus allowing of a much wider range of experimental work than has ever been undertaken in the past. A vast amount of information, which will guide farmers in their agricultural operations, will be gained.

The discovery of the cause of "take-all" and "white-heads" in wheat is a distinct advance in original research.

Material for the preparation of a soil map of Victoria is being obtained. This map will show what manures are required and what crops will grow successfully wherever experimental plots have been planted by the Department. This work, however, is much retarded for want of men and money.

The Botanical Branch was transferred from the Chief Secretary's Department at the beginning of last financial year. Mr. Luehmann, Government Botanist, owing to his state of health, has not been able to give the Department any assistance in initiating new work or assisting further than identifying specimens of plants sent to him from time to time. The National Herbarium, the most valuable in Australia, is also under Mr. Luehmann's care. This Branch should

deal with the introduction of seeds of varieties of crops already grown and of crops which might possibly be introduced. The purity of seeds sold on the market should be under its care, whilst experiments for the extermination of noxious weeds should be conducted by it. The re-organization of this Branch is necessary before any work of real value can be accomplished.

Mr. Crooke, of the Forestry Branch, has supervised the production of a handsome timber trophy for exhibition purposes. This trophy shows to advantage many varieties of Victorian timber, and it is to be hoped that when the public see how many beautiful native woods can be used in cabinet making the tide of fashion will turn to home grown products rather than to those imported.

I have recommended that an experimental irrigation farm should be established so that farmers may learn the most successful method of applying water to the land; that a premium should be paid for stallions with the object of improving the breed of army horses; that shed accommodation be provided for the inspection of fruit for export, instead of carrying it out on the pier—exposed to the sun, wind, and rain—as at present; that steaming depôts be established for the proper cleansing of second-hand fruit cases, thus checking the spread of codlin moth; and that the Chemical Branch be provided with an up-to-date laboratory.

I trust that these recommendations will receive sanction during the year, as they are all urgently wanted.

Chemical Branch.

So far as experimental work is concerned the Chemical Branch is the most important of all the branches of the Department. It has had the advantage of being under the direction of two most capable officers, first, Mr. Pearson and latterly Dr. Howell. Although the work of this Branch has been, and will be, of so much importance to the agricultural community, these advantages have never yet been properly realised, nor the support and encouragement which it deserves given to the work.

Mr. Pearson had to fight his way inch by inch, always hindered by lack of men and money; and since I joined the Department I have made many efforts, some of them successful, to put this Branch on a proper footing. I found that many of the staff were underpaid, and the result was that when young men had spent two or three years in the laboratory they sought appointments elsewhere instead of looking to the Department for their future promotion. Thus the training of others had to be again begun and work consequently retarded. I found an officer, whose duty it was to examine microscopically all the water supplies of Victoria and determine whether they were fit for human consumption, receiving a salary of £75 a year, although he was married and had two children. Another, who had done excellent work for four years and was a competent analyst, received the same salary. These are only examples. Practically two-thirds of the

staff of this Branch were on the look-out for employment elsewhere. This state of matters rendered Dr. Howell's task doubly difficult. Fortunately increased salaries have been granted, and if the same increments are given occasionally we have every prospect of retaining the young men who have received this special training. As Dr. Howell furnishes an extended report, I will not go into the work of the Branch in detail but there are some main features to which I must refer.

Field experimental work has been of immense advantage to farmers. The main question of what manures should be applied to four-fifths of Victorian soils has been answered. In the northern or drier areas a dressing of from 50 to 75 lbs. of superphosphate has been found to be all that was necessary so far, nitrogen and potash not being found to give increased yields equivalent to their cost. In the wetter areas or on the south side of the Dividing Range 2 cwt. of superphosphate applied with a drill, and ½ cwt. to 1 cwt. sulphate of ammonia or nitrate of soda applied broadcast, has been found to be the most economical dressing, while potash as a rule in either wet or dry areas has not given results which would warrant its application. Of course there are numerous other facts as to the relative values of different manures established, but the knowledge of the facts I have stated is a sure guide to manuring on the great majority of Victorian soils, and is worth tens of thousands of pounds to the agricultural community.

We are all rejoicing in the bountiful harvest of the past season, but if it had not been for the Chemical Branch the full benefit of the rains would not have been realised. In an average season in the north, manuring caused an average increase of 5 bushels to the acre whereas this season the average increase has been 10 bushels, so that much of the bountiful harvest is due to the knowledge which farmers have gained from the Department. In Bulletin No. 13 just issued you will find results of experiments conducted during the last season. These have proved that a great number of forage crops can be grown successfully in the south, and show the effect of manuring on these crops besides giving a vast amount of facts of deep interest to farmers.

The method of experimenting in the past has been to establish small experimental fields in co-operation with farmers, but the information gained has only been in reference to one crop. This system, although excellent at first when so little was known, has already served its purpose, and it is now advisable that experiments should extend over a series of years so that the after effects of manuring on succeeding crops can be determined, and that the advantages of fallowing, deep cultivation, rotation of crops, liming, draining, and many other more intricate questions should be decided. It has therefore been arranged that experimental work in future shall be carried out on fields of from 5 to 10 acres, and over a period of not less than 6 years.

An officer will be put in charge of several fields, and farmers who are good enough to undertake the work will be paid for fencing and

extra labor entailed, the produce to be their property. The Hon. the Minister has decided to spend an equal amount on these fields to that spent on experimental plots last year, and if more money be obtained there will be more fields.

To get a true answer as to the needs of Victorian soils we should have not only a field in each district but a field on each variety of soil typical of any large area in each district.

The laboratory work of the Branch is ever increasing. Besides analysing soils sent in by farmers, the Chemist for Agriculture is also Chemist for Water Supply as well, which entails a great number of analyses of water. Many exported products have to be dealt with for the purpose of giving a guarantee of purity. These include butter, preserved milk, tinned meats, jams, pulps, honey, &c., and all have been found, with few exceptions, to be free from adulteration.

In connection with the analysis of soils Dr. Howell is now carrying out a work which will greatly increase the value of the advice given to farmers. Previously when a farmer's soil was analysed the analysis was compared with the analysis of what was known to be a fertile soil in Europe, and from this comparison and from knowledge already gained from experiments here advice was given. It is obviously clear that before a perfect judgment on the analysis of any particular soil can be pronounced we should have a standard analysis of a fertile soil established, not only for the State but for each division of the State where climatic conditions are vastly different. To establish the standard analysis of fertile soils is a work which has been receiving the attention of the Chemical Branch for some time.

An amended Manure Act is greatly needed, and a bill, which I hope will come before Parliament this session, has been prepared. This will enable the Department of Agriculture to appoint an inspector with powers to enter any store or farm building and take samples of manure which, if found to be of a lower grade than they were declared to be when sold or offered for sale, would enable the Department to act.

The present Act provides that farmers may take steps to have manure merchants prosecuted, but as a matter of fact they never do. The work of protecting the farmer from fraud should, therefore, be done by the Chemical Branch.

Pathologist's Branch.

The principal work of the Vegetable Pathologist is to give information to farmers, fruit-growers, market gardeners and others as to diseases of crops due to fungi, together with methods for their prevention. In this connection the branch has examined, microscopically, 1,200 batches of diseased plants during this year, and has furnished by letter the best known methods of checking such diseases. Besides giving information which has been gained in the past, research experiments are constantly being undertaken to discover other facts which will be of value. For example,

Mr. McAlpine tells me that in recent years he has grown in experimental plots over 1,000 different varieties of wheat with the object of finding out a perfect rust resisting variety, and out of all this number only one, "Rerraf," was found to be an almost rust resisting variety. This was distributed last year to 400 farmers who, as a rule, spoke highly of it.

You are aware that "take-all" has long puzzled farmers and scientists who could not say positively what was the cause of the disease. After a great amount of microscopical research, involving the examination of many thousands of plants affected by the disease, Mr. McAlpine discovered that a particular fungus was present in every case. "Take-all" then is a fungus disease, and the next duty of the pathologist is to find out what will prevent it. Experiments with this object are being undertaken this year.

The Vegetable Pathologist has recently announced that the result of experiments conducted by him prove that black spot on apples can be prevented with one spraying in the season. This will be a great aid to orchardists. An article on the subject will be found in the July number of the *Journal of Agriculture.*

Besides this work in connection with the diseases of plants, the Branch is carrying out useful experiments in testing new varieties of wheat, oats and barley as well as native and imported grasses, together with the newest imported varieties of potatoes.

The beneficial effect of leguminous plants grown on soils treated with cultures of nitrogen fixing bacteria imported from the United States, is being tried this season.

Considering that Mr. McAlpine edits the departmental Journal, and has but one assistant, Mr Robinson, I think you will all agree that these two officers do a very good year's work.

Entomological Branch.

Mr. French, Government Entomologist, is now writing the fourth volume of his work upon the Insect Pests of Australia. The three previous volumes were highly appreciated, and have been in demand at home and abroad. The first volume has been sold out at a price which covered the cost of production.

Besides attending to his regular duties as Entomologist, Mr. French acts also as Chief Inspector under the Vegetation Diseases Act. Numbers of prosecutions have taken place during the year against those keeping neglected orchards and exposing diseased fruit for sale in the market.

The Vegetation Diseases Board, whose duty it is to advise the Department, maintains that the law should be more rigorously carried out, and that not only the worst offenders prosecuted as an example to others, but all who sell diseased fruit should be proceeded against. The Board gives as its reasons that the experiments conducted by the Department of Agriculture proved that with proper attention, at least 80 per cent of clean fruit could be obtained, and

that four-fifths of good fruit is a paying crop even although the other fifth is not allowed to be sold. Further, that those who do not obtain good results are, in the interests of the careful orchardists, better out of the business. These reasons seem sound, but there is this drawback, that very few orchardists do get good results. This high percentage of good fruit, which I have no doubt can be got with sufficient skill and care, is difficult to obtain. Personally I know of many instances in which orchardists have been most diligent in spraying and carrying out precautions recommended, yet the percentage of sound fruit was low. The explanation is that they have not yet acquired sufficient skill.

It requires a great deal of experience to know exactly when to spray, and the particular manner in which spraying should be done to secure absolute success. The Department is consequently not carrying out the law with such rigour as it may be possible to do in succeeding seasons. In addition to this, money has not been found for the purpose of erecting stations in Melbourne where second-hand fruit cases can be steamed before they are returned to the country and thus assist orchardists in combating diseases. It seemed to me, therefore, doubly hard that orchardists who are making an effort should be prosecuted.

Money is placed on the Estimates for the erection of two steaming establishments this year, and I hope they will be ready before next fruit season.

Dairy Branch.

During last season it became painfully evident in comparing the price of the best Victorian butter with that of New Zealand and Denmark, that Victorian butter was not commanding the same relative value in the London market as it formerly did. Choicest Victorian butter has been sold at 2s. per cwt. less than choicest New Zealand, whereas four years ago Victorian commanded a better price than New Zealand. To explain this is rather difficult, as Western District butter is supposed to still maintain its high standard, and an excellent system of dairy inspection is said to exist there. It is also said, however, that the good Victorian butter has to carry the bad with it when it reaches London. If this be the case, we must then lessen the proportion of bad so that the load may be lighter to bear.

There is but little doubt that we are making a great amount of inferior butter in Victoria, not on account of our dairy managers being bad butter makers, but on account of the large proportion of stale cream and inferior milk which reaches the factories. This is causing very serious loss to the State as well as to the individual, and it is the duty of the Department not to relax its efforts until this difficulty has been overcome. If it were instruction that was wanted it would be supplied, but instruction would be of no avail without compulsion. A bill will be brought before Parliament, having for its object the effective inspection of milk from the time it leaves the cow until it is exported as butter. This bill has been drafted by the

Department, and is now being considered by a committee of representative and experienced dairymen, and I have every confidence that, when it comes back to the Minister of Agriculture, it will provide adequate means for checking the supply of faulty cream and milk.

The butter industry, on account of its magnitude and importance, has always had the attention and assistance of the State, but the cheese industry, which in some countries is of greater importance, has never been assisted. Victorian cheese ought to be of a higher standard, as the climate and pastures are well adapted to cheese making, yet a considerable quantity of bad cheese is made. Makers of poor cheese do not suffer so much when the supply does not exceed the demand for local consumption—there being a protective duty of 3d. per lb., everything made consequently sells at a price. When, however, the supply exceeds the local demand, and there is a surplus to export, a great number of dairymen suffer because the quality of their cheese is not good enough to pay for exportation.

Much of the best Victorian cheese is sold at present as New Zealand in the retail trade. Now if the greater quantity of the cheese made in this State was of good quality New Zealand cheese would never be heard of. There is no remedy for this state of things but instruction, and this is what the Department of Agriculture will undertake.

Mr. McMillan, an expert cheese maker, who was educated at the best schools in England and Scotland, where he received the highest diplomas, has been engaged. He has also the advantage of having been two years in Australia, and therefore knows something of local conditions. His methods have been approved by the winners of the highest awards at the last Royal Agricultural Show in Melbourne. I have, consequently, every confidence that he will do good work.

Lecturing is of little good to cheesemakers, so the instruction will be of a practical and conversational nature. Mr. McMillan will visit cheese factories and dairies, and will give assistance to those requiring it. He will take his coat off, and show how to make cheese besides giving advice in the direction which he considers necessary, remaining possibly a week or ten days at one factory.

Government Cool Stores.

The Government Cool Stores, as you are well aware, have played a most important part of late years in developing the export trade. The superficial floor space in these stores is 36,000 feet, and the Department pays to the City Council £15,000 per annum for their use. The rent is exceedingly high, but could easily be borne if there was a good export trade. Even in the financial year 1902-3—the worst drought year Victoria has ever seen—the loss on these stores amounted to only £300, after paying rent and all working expenses, which amounted to £32,000.

It is true that in the previous year (1901-2) a loss of £4,500 was made, but this is principally accounted for by the insufficient storage charges made for the business done.

This year (1903-4) will also show a considerable deficit from exactly the opposite reason, viz.: maintaining charges at a high rate, under which private firms could easily cut and secure the small amount of meat export business offering, although had the chambers been occupied we might have been earning a greater proportion of the rent. That these stores can be made to pay, and that they ought to pay in an average season, is of the utmost importance to the agricultural community. Heavy losses will be one of the chief arguments raised by competitors for urging upon the Government and Parliament the advisability of leaving the whole question of freezing in the hands of private firms. It is in the worst interests of the producer that this should be the case. A "combine" of freezing companies could take any profit they pleased out of perishable produce. In fact the farmer in a good season would be entirely at the mercy of these companies, and would have to pay any charges demanded. Take for example a glut in the lamb market. If there are more lambs in the market than the Government Cool Stores can deal with the price immediately falls and owners of private works buy on their own account, making profits far in excess of charges for freezing, however exorbitant these might be.

This profit all comes out of the producer. The Department of Agriculture has realised that it is its duty to assist the producer further by providing additional storage space. This would save unnecessary loss, but the great difficulty up to the present has been that while extra accommodation could have been got from the Melbourne Corporation, the rent of the additional storage would have to be paid for a whole year, though it would only be required for three months at most, thus incurring a certain loss.

After over one year's negotiations I am glad to be able to tell you that at last a satisfactory arrangement as regards additional cool storage space has been come to by which there will be no loss whatever. Cool stores with nearly one-third the capacity of the Government Cool Stores will be put at the disposal of the Agricultural Department in any season during the next five years by our giving a week's notice, and at a rental calculated at 25 per cent. less than what is paid for the present Government Freezing Works. I have not the least doubt but that this will prevent any serious drop in fat sheep and lambs through a glut in the market when a good season comes, and will save the producers thousands of pounds per annum.

Stock Branch.

The fact that the officers of this Branch are not veterinary surgeons has been severely criticised in some quarters. So far as the men now employed are concerned I would advise no change, but consider the time has come when better salaries ought to be offered for stock inspection—thus inducing young veterinary surgeons to offer their services. If a boy has been country bred and afterwards passes through a veterinary college he is surely better qualified than a man, although a good stockman, who has never had the advantage

of such an education. No one should be appointed who has not been brought up in the country, and who does not possess a good practical knowledge of stock, as well as a scientific training.

The health of the stock of Victoria during the last year, except for the unfortunate outbreak of swine fever, has been satisfactory. A few isolated cases of anthrax have occurred, and pleuro has appeared at intervals, but has not been allowed to spread to any extent. As to swine fever, you are pretty well aware of the unfortunate introduction of this disease into Victoria for the first time, and the extent to which it spread before the disease was checked by most stringent regulations. We are, unhappily, not yet free from it. Within the last few months several individuals have suffered very severe losses, and the outbreaks of disease have generally been traced to pigs that have been in contact with diseased pigs before being sold in the open market. I am strongly of opinion that the wisest course would be to close markets for store pigs for several years. This should not be done suddenly, several months notice being given, so that those who require pigs to fatten could breed them for themselves or arrange with someone else to do so.

The closing of the public markets for store pigs would not interfere with private sale and the transport of pigs from one farm to another. So far as fat pigs are concerned there is little danger of spreading disease through their being sold by auction, as fat pigs do not go back to the farms, and if disease appears they can be at once killed without any considerable loss to the owners. Meantime, the best advice I can give is that farmers, who must buy in the open market, should provide quarantine pens at some distance from their piggeries and keep all bought pigs isolated until it is certain there is no disease amongst them. Whether the store markets are closed or not, I am certain that the best and safest policy for everyone requiring pigs for fattening is to breed the young pigs needed on their homesteads.

Poultry tick is still prevalent in the country bordering on the Murray, and the Department has been endeavouring to eradicate the disease. This appears to be no easy task, as the tick which infests poultry is to be found in farm buildings, on palings, and often on trees. It has been found, however, that the tick does not live upon the fowls during the day time, but comes out from crevices and attacks them at night. To keep poultry clean, tick proof fowl houses should be erected. This would enable fowls to be kept successfully, even although the homestead was infected. A bulletin has been issued by the Department containing several plans of tick proof fowl houses, and if the suggestions offered are adopted by farmers, I have great hopes of yet seeing the poultry industry in the Murray districts a flourishing one.

Viticultural Branch.

The viticultural industry of Victoria cannot be said to be expanding at the present moment. The area of vines under cultivation

is decreasing, and there seems little desire on the part of vignerons to make extensions.

I think the position can be explained. The Government gave bonuses for the planting of vines, and all sorts, profitable and unprofitable were planted, almost every vineyard containing many different varieties. Vignerons were new to the business in many cases, and much inferior wine was consequently made. Phylloxera came and effectually stopped planting, and is still responsible for much of the shrinkage that is at present taking place. We are now, however, in this position, that as many varieties have been planted it is consequently well known which are the most suitable and profitable in the different districts. Vineyards, therefore, will not be indiscriminately planted in future.

Phylloxera resistant stock is available in greater quantities than the existing demand, and vignerons who cannot make good wine can now as a rule sell their grapes to the larger growers who have the necessary skill and better appliances.

Two things are needed for the future, viz.: suitable varieties should be planted, and vignerons should be able to make and mature good wine. To enable growers to comply with these two conditions the Department is giving assistance in both directions.

On my recommendation Mr. Burney, an expert cellarman, has been engaged, and it will be his duty not to go about giving popular lectures, but to continually move from cellar to cellar, staying, if necessary, a day or two when needed to give advice and assistance in making, curing, blending, and preparing wine for export. I have great confidence that by this means much of the wine of the State can be greatly improved.

As to re-planting vineyards, the Department is now in a position to give any number of phylloxera resistant cuttings and rootlings to those intending to plant. We have also had more grafted rootlings this season than have been asked for. If I am right that these are the two means by which the industry can be assisted, then the Department is working in the proper direction.

During the year the Rutherglen Viticultural College will be filled with boys who will be trained in all viticultural work, more especially in grafting and raising phylloxera resistant rootlings, so that there may ultimately be a good supply of trained laborers available for employment by vignerons requiring assistance in skilled work.

Burnley School of Horticulture.

This institution has in attendance twenty-six pupils. An annual fee of £5 is charged for tuition, and strange to say the numbers have not decreased since a fee was charged.

The surroundings of the school have been greatly improved, the garden being laid out with great taste under the direction of the Principal.

Mr. Luffmann's work does not end with his duties at Burnley. He has six experimental orchards under his care in various parts of the State, and his popular lectures and demonstrations are greatly appreciated, so much so that he cannot find time to lecture in all centres where his services are desired.

Other Officers.

In addition to Mr. Knight's other duties he is busy in superintending the inspection of exports other than perishable products, and now that the Agent-General has arranged that the War Office will accept the Department's certificate of quality as final, his work will be even more important. One very simple idea of Mr. Knight's will greatly assist in the sale of Victorian Algerian oats. For example, a contract was let in South Africa for a large quantity of oats, the agent arrived in Victoria to execute the order, but owing to the long shape of Algerian oats very few could be procured of the required standard—40 lbs. per bushel. Mr. Knight informed me that the order was likely to go to New Zealand, but that if we passed the oats through the barley awner which is usually attached to thrashing machines he was sure we could raise the weight by two or three lbs. per bushel, and so secure some of the order. This was at once tried, and the result far surpassed expectations, the weight being raised as much as 5 to 6 lbs. to the bushel by this simple process of clipping the tails of the oats, at a cost of ½d. per bag. An order of 100 tons was secured and shipped, and now we are in a position to supply a better, drier, and as heavy an oat as New Zealand, with a fair chance of further orders.

Dr. Cherry has done good service on his lecturing tour in inducing farmers to make better provision for their stock in winter. Numbers of silos have been erected under his supervision, and when the good results of his mission become apparent during this winter it is hoped that the making of ensilage will become more general in future.

Dr. Brown, Inspector of foods for export, has, unfortunately, had very little beef and mutton to inspect, but he is so constituted that he cannot possibly be idle, his natural activity often leading him to undertake work which other officers consider belong to their branches. He was the first to discover swine fever, and declared unhesitatingly that he was sure of his diagnosis. He has assisted me in the management of the Labor Colony and has aided greatly in preventing the spread of fowl tick.

Mr. Hawkins has been engaged to lecture upon poultry, their breeding and management, and his services are very much in demand; large audiences attend wherever he lectures, and good results are already apparent I am very hopeful that through the medium of instruction Victorian farmers will seriously take up poultry breeding as a business, both for export and egg production.

Poultry are one of the most important minor products of the farm, and there is money in them if properly attended to.

Forestry Branch.

The Forestry Branch was transferred to the Agricultural Department a year ago, and I have, in addition to my other duties, acted as Conservator of Forests during that period. I have now, consequently, a good idea of the troubles that exist in that Branch. They are principally political. Everyone who wants a concession, or imagines he has a grievance, approaches the Member for the district, who in turn makes representations to the Minister. This makes it exceedingly difficult for the Minister to prevent shrinkage, and even more difficult to increase the revenue. The fault lies with a number of interested people.

The royalty charges are altogether too low, and are an infinitesimal part of the ultimate price paid for sawn timber by the consumer. In fact the charges are so low that it is not possible to obtain sufficient money for the purpose of supervising the forests. It would be absurd to expect the State to find the money for the management of a Branch which ought to be yielding a substantial revenue. The receipts at present are over £15,000 a year, and without much difficulty these could be increased by £5,000 a year. A substantial balance would then be paid to general revenue after providing for the proper supervision of the forests. This is likely to be done after careful enquiry has been made as to the position and circumstances of each saw mill.

As to what might be done I will take two examples; first, the Healesville and Warburton districts from which comes two-thirds of the sawn hardwood consumed in Melbourne. This timber, by a general arrangement amongst the saw-millers, is sold at 8s. per hundred feet super., and the net profit is 2s. 2d. per hundred feet from timber from the Healesville district, and 1s. 2d. for that from the Warburton district. The sources from which I obtained this information are reliable, and I am assured that this is an average profit after paying for all expenses of conversion from the tree in the forest, freight, cartage, commission, royalty, etc., etc.

The royalty charged by Government is only 2d. per hundred feet, or one-thirteenth part of the profit on Healesville timber and one-seventh on that of Warburton. It is therefore perfectly clear that if double the royalty were charged the price of sawn hardwood need not necessarily be increased to the consumer.

The second example which I will take is the abnormally low royalty paid on red gum. In Victoria 5s. per thousand feet is the royalty, whilst in New South Wales on the other side of the Murray 15s. is charged. At one time the Victorian royalty was 10s. per thousand, and was reduced to 5s. when the Minister for Lands at the time was member for the district where much of the red gum was cut. I could give numerous other examples of low charges, but think this

is sufficient to show that the State is getting far less for the produce of the forests than is fair and reasonable.

I find that in a number of cases well timbered land has been alienated. The State in these cases received 15s. per acre on long terms, and the happy settler has been able to sell the timber without any trouble or labour on his part for sums amounting sometimes to several pounds per acre. This, however, is not the most serious loss sustained by the State by improperly alienated lands. On account of this alienation there is, sometimes, no means of access to portions of the State forests, except through private property, and sawmillers have to make arrangements with these proprietors, by paying amounts for easement, which is more like blackmail than fair value, before the State timber is available.

I found that the executive officers of the Forestry Branch had done all they could, with the limited powers at their command, to preserve the forests.

The foresters have more work to do than can possibly be done thoroughly, and two inspectors cannot possibly supervise the work of the forests. What is wanted is more revenue, which would provide for the employment of a sufficient staff vested with greater powers to prevent the waste of the present timber and protect the young forests for the next generation.

If the protection of the forests be taken in hand at once there need be no fear but that there is in the magnificent forest areas of Victoria sufficient good timber for present requirements and forests enough to provide timber for future generations.

There is no truth in the statement that we will be compelled to import in the near future. As time goes on a few small railway extensions will doubtless be necessary, and some of the forest areas near several of the mining centres will require to be temporarily closed.

Gum forests are easily managed and cheaply re-constituted. There is generally sufficient seed to produce a new crop of timber, and where this is wanting it is only necessary to collect the seed, scatter and scratch it in on country suitable to the production of the variety of timber required. Much can be done in young forests by thinning out useless varieties of timber and giving the more valuable a chance to occupy the ground. The laborious and expensive system of planting necessary in other countries is not required in Victoria.

With proper conservation of the forests Victoria can look with complacence upon the future, and with the full assurance that there is enough timber for the present and future generations.

Labor Colony.

During the last financial year one of my duties has been to superintend the Labor Colony. As a rule this establishment has cost the country £4,000 a year—£2,000 was always provided on the Estimates and an additional £2,000 or thereabouts was provided on the Supplementary Estimates.

During the year just closed no money was required to be provided on the Supplementary Estimates, and there is a substantial sum to credit in the bank. The same amount of relief has been given, that is, all destitute men who have made application at the town office have been sent to the Colony.

It is only natural that men will not go to the Colony unless they are almost starving, as they are at first paid only 1s. 6d. per week with board and lodging, and seldom get more than 2s. 6d. Consequently they do not go there unless compelled by circumstances, and as soon as possible obtain work outside.

I consider this an excellent institution for the unfortunate, and as good for the State as for the individual.

I have caused private and independent inquiries to be made on the Colony, and find that men often arrive there without having had food for 24, and in some cases 48 hours, and they are in such a weak condition that they require one or two days to recover.

Although the farm is not under the direct administration of the Department of Agriculture, yet the Department is so much in touch with it that it will be possible to carry out experimental work which will be beneficial to Gippsland, while some of the experiments will be useful to the whole of the State.

There is a dairy of 50 selected cows which have been culled from the original herd. Experiments in feeding, housing, and rugging are being conducted; and the best crosses for dairying purposes will, I hope, be definitely established by exact experiment. The first cross between the shorthorn and pure bred Jerseys, Ayrshires, and Holsteins will be fed and milked under the same conditions, and the relative values of the different crosses for dairy purposes will be determined by keeping a record of their milk, besides tests being frequently made of their butter yield.

The best breeds of fowls for export and laying purposes are being procured, the eggs of which will be sold at a moderate price to farmers desirous of improving their stock of poultry.

Numerous grasses have been sown, and I hope to conduct the establishment as an experimental farm at very little cost to the State.

The "Journal of Agriculture."

The *Journal of Agriculture of Victoria* has had a chequered career. It was first published in January, 1902, and appeared monthly until September, 1902, when, owing to drastic retrenchment, its publication was stopped for seven months, appearing again in May, 1903. It was then decided, in the interests of economy, that it should only be published every two months, and that a charge of 2s. 6d. be made for the six issues in each year. The farming community have only responded moderately, the subscriptions not being so numerous as they might be. The *Journal*, however, is a necessary adjunct to the Department, as it contains a record of the work of the various officers,

and anyone who does not read it cannot fully appreciate what the Department is doing. There the results of experiments are faithfully recorded, and there is hardly any material in the *Journal* which is not original, comparatively few papers being copied from other periodicals, and these only because of possessing special importance. Let me commend the *Journal* to you and ask you to subscribe. When officers do good work they are naturally glad to know that an account of that work has been read by those in whose interests it has been undertaken.

Agricultural Education.

You are aware that agricultural education has been entrusted to a Council. The form this education has taken has been that of establishing two colleges, one of which, that at Dookie, has been a success both as a college and an experimental farm. I maintain, however, that what is of more immediate service to the agricultural community is the education of the farmers already engaged in farming and their sons who are working with them, rather than the education of prospective farmers. The sons, in many cases, of those not at present engaged in farming may ultimately never take to the business.

The Department of Agriculture has for years had officers on the staff, whose duty it has been to give single lectures on agricultural subjects to meetings of farmers held under the auspices of agricultural societies. This work although useful and interesting cannot be called very educational, as the information given in one lecture does not lead to a better understanding of the next. To meet this difficulty I have had classes of instruction for farmers and farmers' sons, extending over several weeks, held during the last two winters, and this winter the classes are more popular than ever. Seven centres have been selected, namely, Nhill, Warragul, Tatura, Benalla, Wodonga, Rushworth and Wangaratta, and the average attendance will exceed that of former years, possibly 50 students per class. The Department has made no special effort to form classes this season, as the agricultural societies offering to secure the necessary number of students to form classes have been sufficient, and all that could possibly be attended to with the officers available for giving instruction. This method of instruction has come to stay in Victoria, and will extend over the whole of Australia. Enquiries have reached me from other States, and it is only a matter of time before Australian agriculturalists will realise that this is the best method of instruction for the greatest number which can be had at the least sacrifice of time and money. However excellent this system may be, the winter season as a rule is the only time farmers and their sons can devote their days to lectures and study.

To meet all demands for classes during the winter months the Department would require to maintain for a whole year a staff of lecturers who would work for three or four months only, or depend on picking up suitable men for the work during the winter season. Engaging men specially can be done to a small extent, but if it were

attempted on any large scale failure would be the result. I have, therefore, after a great deal of consideration and after consultation with Dr. Howell, who is now supervising the work of the lecturers, matured a plan of keeping them employed throughout the year, and I think there is every chance of making this scheme a success. To organize the matter thoroughly it would be necessary to form an Educational Branch of the Department of Agriculture, with a chief officer who, besides teaching, would make all necessary arrangements and have the teaching staff under his control.

The method I propose is to hold evening classes of two weeks' duration at farm houses. The number of farmers attending at any centre to be from 10 to 12, and the classes to be held all the year round except in the winter time, when the officers would be engaged at the farmers' classes held in the townships, as is being done at present. If this system is to succeed, the co-operation of leading farmers in every district would be necessary—those who would lend a room for the purpose and invite their neighbours to attend.

The lectures would be held in the evening, say one and a half hours' lecture and half an hour devoted to asking and answering questions. Four lecturers would be required, one of whom would arrive on a Monday and stay three days lecturing and discussing such subjects as manuring suitable to the district, tillage, rotation of crops, and kindred subjects. On the fourth day he would leave for another centre, say 20 miles away, and would be replaced by an officer competent to lecture on farm stock, their breeding and management. In two days the second lecturer would leave, being replaced by a third who might lecture upon poultry, the best breeds to be kept for export and laying purposes, the management and feeding of poultry, &c. Two days later this lecturer would be replaced by a fourth who would lecture on other agricultural subjects. The course of instruction at this particular farmhouse would then terminate after ten days' instruction. Four classes would be in progress at one time in farmhouses sufficiently far apart to prevent overlapping and yet near enough for the officer to reach the next centre and lecture on the same day. It will be at once seen that the success of such a scheme depends very largely on the patriotism of the leading farmers, as it is not everyone who has a room that would accommodate ten or twelve farmers and who would be willing to give that room up for two hours each evening for two weeks. As to the lecturers, they would find their way to the nearest township after the lectures were over—to cycle eight or ten miles on a summer evening would be no obstacle. I would not like the scheme to fail from any idea that it would be necessary to offer hospitality to lecturers. I should be glad to hear from farmers who are prepared to give a room for farmers' classes, and that at least ten farmers are prepared to attend for two consecutive weeks.

I propose that these farmhouse classes should be tried in August, when the farmers classes held for a month in townships are finished and the officers are available to do the work.

Conclusion.

I have intentionally not given you an exhaustive report on the work of the Department as this would be impossible in a short paper; besides full details will be found in the *Journal of Agriculture* and the numerous Bulletins that have been issued during the year. I have however given a short review of the work which is being done, pointing out in which direction it is advisable to work in the immediate future with the money which is likely to be available. Greater schemes would mean more money, consequently we must confine ourselves to what is possible.

Speaking generally, I consider that a Department of Agriculture can better advance the interests of an agricultural community by instruction than by any other means. A knowledge of facts, scientific and practical, in connection with a man's business is a great aid to his success. To teach boys in a school and students in a college is of course a simple problem, but how to instruct an agricultural community, each member of which is busily employed both bodily and mentally with his everyday work, is a difficult problem. If this could be done by distributing printed literature, then Victorian agriculturists ought to be well educated already as the weekly papers are full of useful information, and interesting articles from all sources are published in their pages.

A Chair of Agriculture at the University would be useful in educating men who would afterwards become lecturers and officers of the Department of Agriculture, but farmers' sons would never attend in any great number, and I am afraid that those who did would not return to the plough.

Agricultural colleges do not meet the wants of those who cannot spare the time to attend. The only method, so far as farmers are concerned, worth spending money upon, is that in which the teacher is sent to those requiring to be taught. Consequently as long as the Department of Agriculture is under my control, I will forward this method whenever there is an opportunity.

The next important function of a Department of Agriculture is the carrying out of a vigorous and extensive system of experimental work in connection with all agricultural industries so that facts useful to the farmer may be established. Indeed, teaching without the knowledge gained by experiment is often misleading. Results of experiments in Europe and America used as a basis of instruction would be utterly useless here. Of what use would instruction in manuring be without the knowledge that has been gained in Victoria during the last five years. If a chemist who was not in possession of this knowledge came to Australia and analysed your northern soils, he would tell you that you must apply nitrogen and that such small quantities as 50 to 75 lbs. of superphosphate would be quite valueless. Yet we know that he would be wrong in both instances.

If we are to instruct the farmer we must have facts, and these facts can only be got by experiments. I will therefore forward experimental work whenever possible.

The Victorian Department of Agriculture is an excellent one of which the agricultural community may well be proud. It will, I am certain, compare favorably with the Agricultural Departments of other States, and I can assert that this State does much more through its Agricultural Department for the farmers than the Agricultural Department of England does for farmers in the old country. We have many highly qualified and enthusiastic officers working harmoniously together, yet straining every nerve to make their respective Branches a success.

What is required is to give heads of Branches sufficient assistance in men and money, so that the community may reap the full benefit of the intelligence and training of the excellent staff of officers who form the Department of Agriculture.

OFFICERS OF THE AGRICULTURAL DEPARTMENT

REPORT OF THE CHEMIST FOR AGRICULTURE.

F. J. Howell, Ph. D.

The work of the branch for the year under review reveals a striking expansion in all the lines of its former activities, as well as new developments in directions independent of these. The extended period of training in the methods of agricultural chemical analysis, which the younger analysts have now experienced, has at length placed at my disposal a number of assistants sufficiently well equipped to engage in that specialization of work which must form part of the future activity of the branch. Although outside demands for lecturers, capable of explaining on the platform the various relations of chemistry to agriculture, have diverted a number of my officers from laboratory work, the loss to the branch in one direction has been counterbalanced by a gain in, I hope, the other, for it has given the farmer an opportunity of forming, from personal observation, opinions of a number of capable young men who have been, and still are, very poorly remunerated for the important duties they are carrying out. Although there has been shown this increased activity in the lecturing on agricultural chemistry on the part of my analytical staff, the output of analytical work has considerably exceeded the returns of former years; while covering at the same time a number of investigations requiring considerable skill and experience in the operations involved.

The Various Lines of Work.

The work of the branch embraced :—

(1) Analytical operations of the laboratory.

(2) Investigations in the field.

(3) Instructional duties in various country centres.

(4) Clerical duties.

The analytical work was carried out under the supervision of my managing analyst, Mr. Scott, acting under my directions. In addition to the analytical operations of the laboratory, a large amount of microscopic and biological work, necessary to supplement chemical enquiries, was undertaken by my biological chemist, Mr. Price.

The field operations were controlled by 10 field officers, specially trained for the work, and also acting under instructions from the office. The educational duties were largely placed in the hands of Mr. Lee assisted by Mr. Robertson. These officers were directed to take over the management of the short agricultural classes, the supervision of which the Director had placed in my hands. The clerical work which has shown a very marked increase for the year was carried out by Mr. Hatton, assisted by Mr. Hassett. I shall treat of the different lines of activity undertaken by the branch in the order in which they appear above.

I. ANALYTICAL WORK.

The number of samples received during the year and their classification are given in the following list:—

LIST OF SAMPLES RECEIVED FOR ANALYSIS 1903-4

Manures	290
Soils	281
Waters	203
Vegetable Products, &c.	715
Dairy and other Animal Products	117
Fodder Plants and Stock Foods	148
Mineral Deposits	16
Miscellaneous	40
	1,810

THE MANURES INCLUDED:—

152	samples of supherphosphate
7	,, Thomas phosphate
40	,, bonedust and bonemeal
35	,, guano
6	,, rock phosphate
11	,, gypsum
3	,, nitrate of soda
2	,, sulphate of ammonia
4	,, potash chloride
4	,, potash sulphate
3	,, potash nitrate
1	,, kainit
8	,, refuse manure
3	,, blood manure
2	,, limestone
3	,, marl
1	,, shell deposit
5	,, special manures, horticultural, potato, orchard and grass
290	

OF THE MANURES RECEIVED —

104 samples were from manure firms
55 ,, ,, farmers and associations
44 samples were for yearly determination of unit values
18 were samples used in experimental fields
69 were samples collected in accordance with provisions of Artificial Fertilizers Act

SOILS AND SUBSOILS.

OF THE SOILS AND SUBSOILS RECEIVED :—

4	samples	were received	from the	Public Works Department
6	,,	,,	,,	Entomologist's Branch
82	,,	,,	,,	farmers
189	,,	,,	,,	experimental fields
281				

WATERS.

THE WATERS INCLUDED.

141	samples	for sanitary analysis and determination of pollution through dredging
9	samples	for stock purposes
2	,,	boiler and locomotive use
44	,,	butter washing purposes
3	,,	use in irrigation
1	,,	mineral springs
3	,,	detection of poisons
203		

OF THE WATERS RECEIVED :—

141	samples	were from	Victorian Water Supply Department
44	samples	were from	the Dairy Branch
2	,,	,,	Stock Branch
16	,,	,,	farmers

PLANTS AND VEGETABLE PRODUCTS.

These included ;—

8	samples	of preserved fruits
7	,,	fresh fruits
233	,,	jams and pulps
404	,,	beetroot
34	,,	mangolds
2	,,	bark
1	,,	gum
10	,,	fungicide, &c.
3	,,	oils
1	,,	syrup
1	,,	glucose
11	,,	sauces
715		

DAIRY AND ANIMAL PRODUCTS.

These included :—

94	samples	of butter
1	,,	cheese
11	,,	milk
9	,,	honey
2	,,	meat extract
117		

STOCK FOODS.

These included :—

112	samples of	miscellaneous fodders and fodder plants
6	,,	silage
7	,,	bran
1	,,	pollard
4	,,	meals
18	,,	cakes
148		

MINERAL DEPOSITS.

These included ;—

3	samples of	marl
3	,,	pipeclay
8	,,	supposed phosphatic deposit
2	,,	limestone
16		

MISCELLANEOUS.

These included :—

2	samples of	waterproof cloth
9	,,	wood (calorific value)
7	,,	intestines of stock (for poisons)
1	,,	cyanide sand
5	,,	sand from mining battery
1	,,	weed
5	,,	gas
1	,,	paint
4	,,	preservative
2	,,	pitch
1	,,	tar
1	,,	pollen
1	,,	solder flux
40		

Manures.

The number of manures analysed considerably exceeds that of the preceding year. This is partly due to the system, initiated for the first time last year, of sending out field officers to collect samples on the farm. During the course of this work, the discovery was made by the field officers that vendors had, in most cases, failed to comply with the provisions of the Manure Act, in not providing an invoice certificate at the time of sale. Prosecutions were instituted against a number of vendors for this omission in different centres, and fines inflicted. It is satisfactory, however, to find that the failure to provide a certificate was not apparently the outcome of any intention to defraud, as analysis in nearly all cases revealed a high standard of quality. In the cases where invoice certificates had been provided, the figures of analysis exceeded, in most cases, the invoice guaranty.

The following tables contain the results of the examination of 70 samples of different kinds collected by the officers. It will be noticed that the moisture percentage is, in a few cases, rather low, due probably to losses after leaving the store, and this naturally would show a higher content of the fertilizing ingredient, than would be given in the presence of the original moisture.

SUPERPHOSPHATES.

Collected at the Farm of	Moisture.	Phosphoric Acid.		
		Water Soluble.	Citrate Soluble.	Insoluble.
	%	%	%	%
Mr. Ralph Foreman, Tyrrell Creek	6·70	19·10	1·95	·96
,, Sydney W. Tucker, Wycheproof	6·38	18·91	1·90	·84
,, John Kennedy ,, ...	10·65	16·55	2·40	
,, Alex. McPherson ,, ...	12·32	16·34	1·91	
,, J. McGinness, Cowie's Creek	8·45	20·06	2·42	
,, P. Hucker, Lara Lake	10·08	20·14	1·80	
,, J. Robb, Geelong	8·11	19·70	2·11	
,, J. McCurdy, Geelong	11·50	20·69	1·61	
,, C. J. Tadgell, Moolap	9·32	20·53	1·15	
,, D. Rhind, Wallington	10·05	19·70	1·47	
,, H. Martin, Connewarre	10·24	20·04	1·41	
,, F. Schickerling, Warracknabeal	8·84	17·08	1·89	1·56
,, J. Quinn, ,, ...	11·73	16·89	1·04	1·39
,, W. J. Clark ,, ...	12·87	16·45	2·81	1·37
,, A. McDonald ,, ...	6·70	18·70	·35	·81
,, D. W. Tarrant ,, ...	7·43	17·22	1·12	2·60
,, W. Fensom ,, ...	11·28	17·46	1·40	1·89
,, C. Weir ,, ...	12·13	15·84	3·06	2·86
,, H. Hayter ,, ...	10·66	21·23	1·06	
,, A. Kinghorn ,, ...	13·77	18·41	3·55	
,, J. W. Inkster ,, ...	12·61	16·49	2·32	
,, D. A. Kinghorn ,, ...	12·84	16·23	2·28	
,, J. Talbot ,, ...	10·62	17·08	1·84	
,, J. Moloney, Minyip	11·70	17·65	·86	3·56
,, J. Burton	9·96	15·87	2·37	2·04
,, A. King	8·90	17·28	3·15	
,, M. McLean	12·64	17·65	1·13	1·14
,, Minkie	8·35	19·20	3·06	
,, G. Harris, Horsham	7·93	18·20	1·21	2·20
,, Stan. Young ,, ...	9·75	17·65	1·50	1·96
,, R. H. B. Guest, Horsham	12·22	18·18	·96	1·20
,, H. Wilks ,, ...	11·88	18·42	1·24	1·32
,, H. H. Harding ,, ...	8·79	18·04	3·08	
,, Stan. Young ,, ...	9·66	18·24	2·88	
,, A. McLennan ,, ...	9·54	18·78	2·82	
,, F. M. McIntosh ,, ...	11·06	12·76	1·93	
,, Curnow, Charlton	8·46	19·48	1·54	
,, Robertson ,, ...	11·82	20·99	·84	
,, Robertson ,, ...	11·34	19·02	1·73	
,, R. Kendale ,, ...	13·69	16·27	1·89	
,, Judd ,, ...	4·29	22·39	2·30	
,, Howard ,, ...	8·87	19·67	2·33	
,, Howard ,, ...	6·08	21·44	1·58	
,, Davis ,, ...	9·79	17·33	2·75	
,, E. Bowman, Dunolly	3·92	16·02	3·66	4·14
,, Anderson, Boort	12·44	17·17	4·14	
,, Williamson ,, ...	10·93	16·24	2·05	
Average of 47 samples	9·98	18·18	1·99	·67

NITRO-SUPERPHOSPHATES.

Collected at the Farm of	Moisture.	Nitrogen.	Phosphoric Acid.		
			Water Soluble.	Citrate Soluble.	Insoluble.
	%	%	%	%	%
Mr. J. Robb, Geelong	10·30	·68	10·44	2·10	7·94
,, W. McCurdy, Geelong	11·20	·27	14·72	3·71	2·00
,, D. Rhind, Wallington	11·28	·61	10·66	2·66	7·68
,, J. Larkin, Leopold	11·16	·63	9·64	5·45	6·63
,, G. Bacon, Barwon Heads	12·27	·78	11·27	2·93	5·93
Messrs. J. & P. Paech, Germantown	10·94	·70	12·52	3·23	6·11
Mr. Howard, Dunolly	7·20	·93	11·48	4·86	5·50
,, Geo. Beard, Dunolly	6·20	·73	15·54	4·42	2·30
,, Freemantle ,, ...	5·70	1·01	16·10	2·74	3·58
,, M. Murphy ,, ...	7·45	·75	13·81	3·40	2·46
Average of 10 samples	9·37	·70	12·61	3·55	5·01

BONEDUSTS.

Collected at the Farm of	Moisture.	Nitrogen.	Phosphoric Acid.	Mechanical Condition.	
				Fine.	Coarse.
	%	%	%	%	%
Mr. P. O'Brien, Cowie's Creek	10·63	3·45	19·52	39·70	60·30
,, ,, ...	4·84	3·40	25·29	60·56	39·44
, J. McGinness ,, ...	6·90	3·41	23·14	67·75	32·25
,, ,, ...	6·00	4·75	21·17	45·06	54·94
,, D. Sutherland, Lara Lake	8·53	3·87	24·55	27·05	72·95
,, P. Hucker ,, ...	6·14	3·92	20·85	32·84	67·16
,, J. Robb, Geelong	9·58	3·75	26·31	17·21	82·79
,, Mitchell, Connewarre	11·69	2·02	17·02	36·66	63·34
,, R. Reid ,, ...	10·16	1·99	16·26	44·24	55·76
,, ,, ...	11·07	2·03	16·96	39·77	60·23
,, A. Pearson ,, ...	9·44	2·10	16·50	48·23	51·77
Average of 11 samples	8·63	3·15	20·68	41·73	58·26

The average percentage, taking 47 samples of superphosphate, of 18·18 per cent. water soluble and 1·99 citrate soluble phosphoric acid, as disclosed by analysis, is striking evidence of the high standard of quality reached by this class of fertilizer.

The nitro-superphosphates contain too large a percentage of insoluble phosphoric acid, and too small a percentage of nitrogen, to secure a similar position. They are, in many cases, mixtures of superphosphates and bonedusts depending for their small content of nitrogen for that contained in the added bone. Where invoice certificates have been given, it was found that the guaranty of nitrogen was below the figures actually found. The bonedusts may be considered a fair average sample, although samples have been sent in, by individual farmers, of an exceedingly low standard.

Samples for the Determination of Unit Values.

There is at present, no law making it compulsory for manure manufacturers and importers to send to the Agricultural Chemist samples of manures, together with the prices demanded for the year. A number of merchants, however, do this voluntarily, and from this list an attempt is made to calculate the unit values of the different fertilizing ingredients. As the list, however, is by no means complete, the figures cannot be regarded as anything more than approximations, and the Amending Manure Bill, already introduced to Parliament with the intention of remedying this, makes it compulsory for all vendors to send in samples each year.

The following list gives the results of the analysis of 45 samples sent in voluntarily :—

SUPERPHOSPHATES.

	Moisture.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. Insoluble.	Total Phosphoric Acid.
	%	%	%	%	%
Sample No. 11,956	12·14	15·99	2·35	—	18·34
,, 12,021	5·81	15·50	1·94	1·92	19·36
,, 12,022	6·09	18·00	1·60	2·21	21·18
,, 12,023	6·45	19·24	1·52	2·14	22·90
,, 12,024	6·86	20·48	1·77	1·81	24·06
,, 12,025	7·84	16·59	1·47	1·31	19·37
,, 12,026	9·48	12·14	2.51	—	14·65
,, 12,027 (concentrated superphosphate, not included in average) ..	11·48	38·75	5·90	·80	45·45
,, 12,060	10·38	19·08	2·20	—	21·28
,, 12,129	8·06	16·54	2·50	1·70	20·74
,, 12,131 (concentrated superphosphate, not in average)	10·87	39·68	5·22	·25	45·15
,, 12,132	3·23	15·06	4·11	3·30	22·47
,, 12,166	12·78	17·65	1·94	—	19·59
Average of 11 samples	8·10	16·93	2·17	1·30	20.35

NITRO-SUPERPHOSPHATES.

	Nitrogen.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. Insoluble.	Total Phosphoric Acid.
	%	%	%	%	%
Sample No. 12,029	1·55	12·68	6·06	·48	19·22
,, 12,130	·89	10·83	5·16	3·66	19·65
,, 12,134	1·42	6·00	5·90	9·56	21·46
Average of 3 samples	1·28	9·83	5·70	4·56	20·11

BONEDUSTS.

	Moisture.	Nitrogen.	Phosphoric Acid.	Mechanical Condition. Fine	Mechanical Condition. Coarse.
	%	%	%	%	%
Sample No. 12,033	4·50	2·53	25·04	28·43	71·57
,, 12,062	4·74	2·92	17·32	71·55	28·45
,, 12,063	3·86	1·95	19·41	55·47	44·53
,, 12,133	20·76	3·76	20·84	48·44	51·56
,, 12,135	8·10	3·79	24·32	25·89	74·11
,, 12,164	8·45	3·33	23·88	27·42	72·58
,, 12,165	10·71	3·72	17·49	36·08	63·92
,, 12,176	5·90	4·46	20·20	19·20	80·80
,, 12,221	7·09	3·41	20·82	33·81	66·19
Average of 9 samples ..	8·23	3·31	21·03	38·48	61·52

THOMAS PHOSPHATES.

	Citrate Soluble.	Insoluble.	Total Phosphoric Acid.
	%	%	%
Sample No. 12,028	9·33	7·26	16·59
,, 12,140	10·18	5·82	15·96
Average of 2 samples	9·75	6·54	16·27

NITROGENOUS MANURES.

	Moisture.	Nitrogen.	Potash.
	%	%	%
Blood	11·32	9·58	—
Nitrate of soda	1·40	15·65	4·53
,, ,, ...	2·20	15·62	5·59
Nitrate of potash	1·25	13·49	45·62
Sulphate of ammonia	—	20·38	—

POTASSIC MANURES.

	Moisture.	Potash.
	%	%
Potash chloride	—	61·51
Potash sulphate	·44	51·91
Kainit	2·36	13·30
Potash sulphate	·13	52·74
Potash chloride	·14	62·95

MIXED MANURES.

	Nitrogen.	Phosphoric Acid.			Total Phosphoric Acid.	Potash
		Water Soluble.	Citrate Soluble.	Insoluble.		
	%	%	%	%	%	%
Potato manure	·88	5·90	7·98	5·44	19·32	5·02
Grass	2·10	3·83	7·47	2·58	13·88	3·52
Orchard and Onion manure	1·26	9·07	4 33	3·60	17·00	6·52
Horticultural ,, ...	1·20	7·80	5·41	·43	13·64	10·25
Legumes ,, ...	·11	7·05	2·71	12·64	22·40	5·02
Average of 5 samples	1·11	6·73	5·58	5·93	17·84	6·06

GUANOS.

	Moisture.	Nitrogen.	Phosphoric Acid.
	%	%	%
Sample No. 12,167	6·47	·84	28·96
,, 12,138	4·14	—	31·23
,, 12,139	1·87	—	21·90
Average of 3 samples	4·16	·28	27·36

The average composition of the superphosphates in the season's manures, shows no material difference from that of the samples collected by field officers. The same applies to bonedust. The nitrate of soda contained large impurities in the shape of nitrate of potash. The two samples of Thomas phosphate sent in are inferior owing to the large percentage of insoluble phosphoric acid. The potassic manures are shown by analysis to be up to the usual standard.

Soils.

The bulk of soils received at the laboratory were those taken by officers from the unmanured plots of the manure test fields. The object of the analysis of such samples is the co-ordination of field results with those of laboratory investigations. It is thought that such a system might, after a few years of such work, offer data, which will allow of the expression of more definite opinions on the manurial requirements of soils sent in indiscriminately. The falling off in samples sent in by farmers is accepted as a satisfactory indication of the effect produced by the numerous field tests. It is a rarity now to receive a sample from the Northern areas, where field experiments have demonstrated, so conclusively, the almost universal deficiency of phosphoric acid as the only question requiring immediate consideration. The more recent experiments on the soils south of the Dividing Range will help materially, to reduce the number of samples sent in, in the future, from that portion of the State, and leave time for more attention being given to the examination of samples from experimental areas.

Waters.

The greater number of water samples were from the Water Supply Department, partly for sanitary analysis, and partly for the determination of the effects of dredging operations on the pollution of various supplies. The bulk of the remaining samples was received through the Dairy Branch, and were sent in to secure opinions on the suitability for butter washing purposes. Although the samples from the Water Supply Department considerably exceeded in number those received during the preceding year, the advisability of a considerable extension of this class of work, in the direction of a more regular periodic examination of all supplies, has not been lost sight of. If provision were made for a more systematic examination of supplies throughout the year, and were continued for a number of years, a mass of valuable data would result, of great assistance in the interpretation of results. The tendency everywhere is to attach too great a value to the isolated analysis, and too small an importance to the long continued and regularly conducted examinations. The necessity for providing for an expansion of work on the part of the chemist, in this department also, should be recognised. An energetic irrigation policy in the Northern districts opens up the possible presentation of numerous problems for the chemist's attention. The high saline content of most of the Mallee soils especially, suggests the desirability of a chemical survey of the sub-soils included within the area. By injudicious systems of water application, disastrous results may follow, as evident in the earlier experience of Mildura. It is not possible, in the space at my disposal, to give the results of the year's analysis of country domestic water supplies. As, however, information on the condition of the butter factory supplies will probably have some interest for producers, the results of a few investigations in this direction are repeated. The list contains samples on which a complete sanitary analysis was conducted. In the remaining cases either a partial or complete mineral analysis only was required.

THE ANALYSIS OF DAIRY WATERS.

	Name of Factory.												
	Grasmere Factory, Warrnambool.	Factory, Sale. Sample No. 1.	Factory, Sale. Sample No. 2.	Bloomfield Co-Operative Factory.	Factory, Welshpool	Factory, Macarthur.	Factory, Boort.	Factory, Warrnambool.	Factory, Traralgon.	Factory, Broadford.	Factory, Warragul. Sample No. 1.	Factory, Warragul. Sample No. 2.	Average of 12 Samples.
Total Solids, dried at 150° C. ..(Parts in 100,000)	105·20	246·25	7·16	26·40	181·84	137·60	5·92	81·76	15·90	12·92	14·0	14·4	70·78
,, ,, ignited	70·00	193·72	4·24	11·80	155·08	107·88	4·52	80·44	12·72	10·36	12·6	10·4	47·81
Chlorine	32·94	106·02	1·17	6·48	84·99	45·34	·91	22·95	4·70	3·73	5·1	5·1	26·61
Hardness, temporary	7·7	6·4	·4	·20	1·60	8·6	·60	6·90	·90	·40	1·0	1·0	
,, permanent	21·00	2·5	nil	nil	4·00	3·5	nil	8·40	nil	nil	nil	nil	3·28
Nitrogen, Ammonia free..	·006	·012	·008	·008	·004	·007	trace	trace	·002	·005	·046	·017	·009
,, ,, Albumenoid	·002	·002	trace	·018	·010	·007	·005	·002	·002	·010	·016	·015	·008
,, as Nitrates and Nitrites	·006	·005	·039	1·284	·001	·53	·061	·053	·021	·010	·030	·030	·172
Oxygen Absorbed in 5 minutes	·09	·19	·20	·40	·25	·04	·09	·92	·51	·45	·57	·94	·38
,, ,, 1 hour	·19	·39	·35	·61	·69	·14	·21	1·90	·73	·68	·88	1·19	·66
Reaction before boiling	Slightly Alkaline	Strongly Alkaline	Slightly Alkaline.		Alkaline	Slightly Alkaline.		Alk'line	Very Faintly Alkaline.				
,, after boiling	do	do.	do.	do.	Alkaline	do.		do.	Faintly Alkaline.		Alkaline.		
Color	Clear, Faint Bluish Tint.	Clear, Colorless.	Clear, Faint Yellow.	Red'ish Yellow	Very Pale Straw	Clear, Faint Bluish Tint.	Very Faint Straw Tint.	Almost Colorless.	Pale Straw	Straw slightly turbid.	Straw slightly turbid.	—	
Bacterial Examination—													
No. of bacteria in 1 c.c. of the water growing on Nutrient Gelatine at a temperature of 20° C. :—	11410	1144	470	2765	1633	27000	523	570	520	1077	1670		
No. of bacteria in 1 c.c. of the water growing on Nutrient Agar at a temperature of 37° C. :—	118	810	204	108	50	574	22	12	3000	512	52		

A set of questions as to the source of supply, and possible sources of pollution, has invariably been sent to factories sending in samples, but this information has not been given as fully as desirable. Evidence of contamination, however, appeared conclusive in certain instances and were reported to the Dairy Expert. Many of the samples were of a low organic and inorganic purity.

Vegetable Products.

The most important items under this heading were the jams, jellies and pulps, collected and sent in by officers responsible for the inspection of this class of export products. The jams, which were taken by Dr. Brown from the stock of seven of the largest manufacturing firms in Melbourne, were subjected to a comprehensive chemical and micro-chemical analysis. In addition to the determination given below, tests for the presence of preservatives, artificial sweetening materials and colouring matters, were also carried out. In the case of three firms, there were two brands of the fruit product sent in, corresponding to first and second quality. In the case of the second quality, the label on the tin in most cases bore in prominent letters the name of one particular fruit, and beneath this, in small and inconspicuous characters the words "and other pure fruits," which were not specified. This appeared to indicate that the intention of the manufacturer was to convey the idea that the quality had not been decided by the use of an inferior sample of the main fruit, supposed to form the bulk, but had secured the designation of the lower grade through not being composed entirely of the one fruit. The use of small letters can however only be regarded as misleading; and it should be made compulsory to state on the label the name of the fruit or fruits added. The quality also, apart from a particular brand, should be stated. Micro-chemical analysis revealed the fact that in some instances, the bulk of the material was by no means composed of the fruit bearing the prominent letters on the label, but that this in cases formed a small portion; and that the main body was made up of admixtures. Certain chemical reactions also suggested that the fruits forming this admixture were, in cases, of an inferior quality. The samples which were classed by the collecting officer as first quality jams, were of a high standard and free from such defects. A chemical analysis of 188 samples gave the following results:—

Jams and Jellies.—First Quality.

JAMS.

Name of Jam.	Average of No. of Samples.	Total Solids.	Protein.	Polarization. Direct.	After inversion.	Temperature. ° C.	At 86° C.	Ash.	Sulphates in Ash.	Chlorides in Ash.	Total Acidity as Sulphuric.	Volatile Acid as Acetic.	Alcohol Precipitate.	Ash in Alcohol Precipitate.
Apricot	6	65·18	·56	+48·21	—19·43	18·4	— ·5	·55	·032	·014	·799	·008	1·302	·036
Blackberry	4	69·46	·87	+11·07	—17·90	18·5	—1·30	·35	·036	·015	·487	·011	·957	·032
Black Currant	6	70·68	·57	— 8·40	—18·0	18·0	—1·4	·48	·058	·015	1·013	·037	1·130	·051
Cherry	1	72·16	·49	+32·0	—22·5	17·5	—1·0	·27	·019	·005	·196	·003	·497	·020
Fig	5	69·14	·44	+43·9	—18·6	17·5	—1·70	·42	·047	·012	·364	·003	2·170	·060
Gooseberry	6	63·86	·62	—11·60	—18·5	17 5	— ·25	·31	·038	·009	·801	·008	1·020	·032
Ginger Pear	1	69·79	·37	+33·10	—25·60	17·5	—2·40	·22	·032	·010	·196	·005	·645	·050
Peach	5	66·87	·56	+34 50	—21·10	18·7	— ·5	·49	·025	·008	·276	·003	1·127	·035
Pineapple	1	70·68	·76	+12·50	—19·50	18·5	·0	·30	·043	·008	·382	·006	·617	·024
Plum	5	66·60	·38	+ 3·16	—19·79	19·4	— ·5	·39	·034	·006	·570	·010	1·060	·032
,, Cherry	1	60·14	·25	+ ·40	—20·80	20·5	—1·0	·42	·020	·005	·588	·013	·796	·016
,, Diamond	4	65·14	·25	— ·03	—18·3	20·4	— ·12	·35	·033	·008	·699	·012	·841	·037
,, Damson	3	64·98	·38	+10·27	—17·83	19·83	— ·33	·30	·020	·009	·620	·019	·740	·029
,, Green Gage	4	65·02	·31	+ 9·70	—19·37	20·0	·0	·33	·011	·006	·419	·009	·957	·030
,, Golden Gage	1	68·17	·69	+16·50	—19·0	19·5	·0	·35	·031	·010	·310	·009	2·129	·017
,, Golden Drop	6	65·63	·25	+ 5·59	—19·57	19·10	—1·16	·31	·024	·004	·522	·009	1·190	·025
,, Magnum Bonum ..	3	64·03	·44	+ 6·70	—18·50	19·6	— ·53	·31	·026	·007	·522	·014	1·370	·040
,, Orleans	2	65·63	·37	+ ·20	—19·10	20·5	—1·0	·31	·029	·012	·730	·017	1·99	·042
,, Sydney, late	1	68·50	·37	+ 7·20	—22·0	17·5	—2·50	·30	·031	·006	·470	·012	1·027	·037
,, Purple Gage	3	66·29	·37	+12·4	—19·0	20·0	— ·8	·34	·024	·008	·416	·013	1·176	·039
,, Violet	1	67·88	·37	+15·5	—18·80	20·5	·0	·33	·028	·011	·550	·014	1·009	·026
,, Yellow Gage	4	66·80	·31	+ 5·52	—20·2	19·2	—1·2	·32	·017	·006	·456	·006	1·554	·020
Marmalade	6	68·04	1·14	+32·60	—18 60	20·5	—1·6	·22	·017	·025	·184	·005	1·644	·025
Quince	6	64·94	·47	+ 4·68	—18·68	17·5	—1·8	·29	·036	·011	·396	·005	1·520	·034
Strawberry	2	68·05	·49	+13·90	—19·70	17·5	—2·4	·48	·038	·012	·593	·008	2·253	·073
Raspberry	6	67·15	2·00	— 1·96	—20·14	17·5	—1·4	.30	·043	·010	·641	·016	1·291	·026

JELLIES.

Name of Jellies.	Average of No of Samples.	Total Solids.	Protein.	Polarization. Direct.	After inversion.	Temperature. ° C.	At 86° C.	Ash.	Sulphates in Ash.	Chlorides in Ash.	Total Acidity as Sulphuric.	Volatile Acid as Acetic.	Alcohol Precipitate.	Ash in Alcohol Precipitate.
Apple	7	68·27	·26	+21·22	—23·92	17·5	—2·91	·20	·023	·009	·235	·006	1·141	·051
Black Currant	1	61·02	·49	— 7·50	—21·20	17·5	—1·50	·43	·037	·013	1·809	·002	1·822	·045
Red Currant	1	70·31	·62	+ 1·50	—23·00	17·5	—2·5	·54	·062	·020	·320	·006	1·502	·052
Cape Gooseberry	1	69·80	1·12	+23.90	—17·30	17·5	·0	·68	·05	·033	·835	·012	·134	·050

MIXED FRUITS.

Apple and Lemon	1	54·89	·67	—12·5	—18 30	17·5	·0	·27	·016	·008	·735	·007	1·077	·043
,, ,, Plum	1	59·14	·25	— 5·7	—17·0	17·5	·0	·26	·005	·008	·597	·012	·906	·018
Lemon Conserve	1	65·10	·06	—15·50	—20·03	17·5	—2·4	·18	·032	·010	·340	·004	·545	·023
Raspberry and Gooseberry ..	1	69·47	·29	— 7·60	—19·7	17·5	—2·0	·36	·045	·013	·833	·016	·247	·057
Apple Conserve	1	65·96	·37	— 3·2	—21·8	17·5	—4·0	·27	·031	·017	·259	·008	1·113	·055
Pineapple and Peach	1	68·46	·62	— 28·0	—21·8	17·5	—2·0	·67	·037	·018	·419	·004	1·005	·030
My Favorite	1	75·38	·80	+34·9	—19·0	18·6	— ·0	·39	·015	·013	·284	·003	·432	·014
Blackberry and Apple ..	1	66·24	·76	+14·0	—17·0	17·5	— ·5	·32	·022	·013	·421	·004	1·060	·028
Red Currant and Raspberry ..	2	68·75	·67	— 4·85	—19·35	17·5	—2·5	·36	·042	·011	·651	·021	1·810	·052
Apricot and Pineapple ..	4	66·09	·69	+13·20	—19·5	17·5	—1·8	·43	·044	·024	·616	·005	1·252	·029
Ginger and Melon	5	66·94	·37	+22·53	—15·6	17·5	—1·5	·37	·053	·018	·251	·004	1·189	·045
Lemon and Melon	6	66·79	·18	+23·87	—14·91	17·5	—2·15	·35	·047	·026	·230	·005	1·722	·060
Pineapple and Melon	4	67·16	·18	+27·80	—10·97	17·5	+1·25	·39	·045	·021	·188	·005	1·246	·049

Jams.—Second Quality.

Name of Jam.	Average of No. of Samples.	Total Solids.	Protein.	Polarization. Direct.	After inversion.	Temperature. Degrees.	* At 86° C.	Ash.	Sulphates in Ash.	Chlorides in Ash.	Total Acidity as Sulphuric.	Volatile Acid as Acetic.	Alcohol Precipitate.	Ash in Alcohol Precipitate.
Apricot	3	65·82	·49	+11·20	—19·20	17·5	—1·30	·469	·031	·011	·741	·011	1·015	·025
Blackberry	1	72·44	·56	— 9·5	—15·5	17·5	— ·50	·440	·013	·006	·627	·018	·899	·042
Black Currant	4	67·45	·62	— 3·2	—18·3	17·5	— ·5	·49	·077	·012	·776	·030	1·184	·046
Fig	2	64·98	·38	+29·2	—18·3	17·5	—1·10	·530	·045	·014	·314	·002	1·675	·046
Gooseberry	4	62·20	·62	— 8·24	—18·43	17·5	—2·6	·30	·040	·007	·751	·011	·792	·030
Peach	3	64·37	·38	+22·90	—21·40	17·5	—1·4	·40	·024	·014	·341	·002	1·083	·035
Plum	4	63·55	·49	+20·20	—18·80	17·0	— ·03	·34	0·21	·009	·510	·013	1·150	·034
,, Damson	1	64·08	·31	— 5·60	—19·80	18·75	— ·75	·41	·019	·003	·600	·012	1·685	·042
,, Diamond	3	66·24	·43	+ 1·36	—20·26	19·2	— ·5	·45	·033	·013	·574	·020	1·10	·045
,, Green Gage	2	61·99	·31	+ ·5	—19·75	20·25	—1·0	·26	·022	·006	·495	·014	1·355	·028
,, Golden Drop	3	65·91	·23	+ 7·59	—20·66	19·3	—1·23	·32	·040	·005	·446	·007	1·170	·035
,, Magnum Bonum ..	1	67·57	·49	— 6·30	—12·50	19·8	— ·5	·530	·024	·007	·740	·021	1·480	·047
,, Orleans	2	61·14	·43	+ 3·40	—18·60	18·5	— ·25	·38	·025	·006	·640	·016	1·451	·033
,, Violet	1	64·66	·56	— 7·20	—15·00	17·8	— ·50	·49	·026	·007	·740	·017	1·020	·060
,, Purple Gage	1	65·44	·37	+ 1·0	—21·00	20·0	— ·0	·34	·010	·003	·590	·019	1·570	·030
Marmalade	4	68·63	·98	+25·60	—18·00	20·5	—1·20	·23	·013	·023	·248	·004	1·385	·023
Quince	4	58·19	·24	+12·75	—16·85	17·5	— ·20	·32	·038	·010	·282	·012	1·038	·021
Raspberry	4	65·71	1·75	+ 5·55	—18·70	17·5	—1·85	·55	·062	·014	·636	·038	1·420	·043
Lemon and Melon	4	67·99	·31	— 7·87	—16·70	17·5	—1·53	·360	·038	·032	·260	·007	2·230	·033
Red Currant and Raspberry ..	1	68·13	·37	+ 1·0	—18·90	17·5	—2·0	·35	·044	·013	·392	·004	·892	·047
Apricot and other fruits ..	1	61·40	·55	+ 5·40	—18·9	17·5	— ·5	·66	·062	·010	·450	·003	1·004	·052
Apple	1	64·98	·30	+18·00	—21·5	17·5	—2·0	·31	·043	·010	·245	·006	·525	·026
Orleans Plum and other fruits ..	1	60·02	·18	+ 2·50	—18·2	17·5	—1·5	·27	·030	·012	·35	·009	3·33	·124
Raspberry and other fruits ..	1	63·27	·06	+ 5·70	—17·2	17·5	— ·0	·36	·052	·023	·411	·004	·550	·027

REMARKS ON THE RESULTS OF ANALYSIS.

It is not possible in a short report of this nature to criticise the results of the chemical analysis of the jams as a whole. Certain interesting facts however are apparent, which may serve as a guide in forming opinions in certain directions, and assist in any future examination of samples which might take place. The high average protein content of the first quality raspberry jams is possibly due to an addition of gelatine in certain of the samples which appear to show an unduly high nitrogen percentage. Glucose was determined in fairly large quantities in three samples of the second class quality. The examination undoubtedly shows that if the quality of samples generally on the open market is to be judged by the samples sent in by the Inspector of Foods, the jams produced in Victoria are of a high standard of purity. It is not pretended that this may be due to the existence of a higher commercial honesty prevailing in Victoria than elsewhere, but to the fact that fruit can be so cheaply purchased by the manufacturer as to render unnecessary the use of inferior materials as adulterants.

* It was found with the instrument used in this laboratory that by a more gradual and lengthy treating at 86 degrees than that usually adopted, the reading in nearly all cases either stood at or approached very closely to Zero.

RESULTS OF ANALYSIS OF HOME MADE AND LABORATORY PREPARED JAMS.

	Black Currant.	Blackberry.	Cherry.	Gooseberry.	Raspberry.	Strawberry.	Red Currant.	Apricot.	Fig.	Cherry Plum.	Slipstone Peach.	Riversdale Plum.	Early Orleans Plum.
	12194	12195	12196	12197	12198	12199	12200	12201	12202	12203	12204	12205	12206
	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
Total solids	67·36	71·95	84·49	72·50	67·04	78·12	72·68	73·89	67·66	70·28	71·69	72·72	
Protein	·87	·93	·25	.62	·92	·31	·68	·43	·50	·43	·55	·43	·49
Polarization direct	+2·8	+31·70	+27·5	−16·5	−1·0	−14·5	−16·0	−14·0	+49·0	−13·0	+46·0	+23·0	−10·0
,, after inversion ..	−18·0	−19·75	−26·0	−18·0	−20·0	−18·5	−20·0	−18·5	−17·5	−20·0	−20·5	−15·0	−17·5
,, temperature °C ..	23°	23°	23°	23°	24°	24°	24°	24°	24°	24°	24°	24°	24°
Ash	·505	·385	·350	.379	.401	·408	·405	.495	·295	·402	.355	·462	.306
,, sulphates in ash	·076	·006	·002	·032	·012	·004	·059	·058	·056	·030	·030	·026	·026
,, chlorides in ash	·005	·005	·003	·011	·004	·012	·002	·006	·004	.008	.007	·008	·027
Total acidity calculated as sulphuric	1·170	·404	·261	1·09	·895	.400	1·055	1·435	·126	·748	·440	·686	·520
Volatile acids calculated as acetic ..	·009	·004	.003	·006	·024	·005	·004	·006	·003	·007	·003	·006	·013
Alcohol precipitate	·969	·370	·536	1·14	·498	·735	2·68	2·000	2.800	·515	·450	·490	·821
Ash in above	·061	.020	·010	·028	·028	·025	·038	.056	·097	·016	·022	.013	·017

Home-made Samples.

At the time of making the examination of the jams, it was not possible to obtain all of the fruits for preparing corresponding products of known purity to serve as laboratory standards of reference. Where these failed, samples of domestic manufacture, however, were obtained. In this manner, using known quantities of water and added sugar, a fairly complete list was secured which, until opportunity is afforded of a more desirable form of preparation, may be regarded as meeting for the time being the desired purpose. As Bigelow points out however, "There is little value in a comparison of jams made from different fruits, by taking as a basis the amount of any constituent present, as the variation is too great." In the home-made samples the amount of sugar used, probably exceeded that used generally in the factory. Boiling also, in the case of watery fruits, is usually continued in the home beyond the time usual in the factory. The higher solid contents generally, of the home-made samples are explained by these two causes.

The Microscopic Examination.

The presence of preservatives, starch, glucose, and certain other adulterants, may be revealed in a fruit or vegetable product by chemical analysis alone, but chemical analysis will not disclose with any certainty, the presence of inferior fruit or vegetable pulps, seeds, etc., in a jam. For their identification we have to depend upon the use of the microscope. The identification implies however a knowledge of the microscopical structure of the fruits themselves. Through the presence of certain characteristic histological features in the various fruits, it is possible to make these serve a diagnostic purpose in the detection of admixtures. The most recent work with this object, is that by A. L. Winton, of the United States. His published results have assisted largely in the microscopic examination of all the jams which was carried out by my Biological Chemist, Mr. C. A. Price. The work of Bigelow, Chief of the Food Laboratory of the United States Department of Agriculture, furnished in a large degree also the methods of examination generally employed. The photographs showing some of the characteristic features of the fruits are the work of Mr. Price.

Mr. Price's Report.

Mr. Price in his report states :—" Of the 138 samples of jams and jellies, first quality, which were examined, only two samples, blackberry and red currant jelly, were found to contain fruit other than that mentioned on the label. None of the samples were found to contain any of the preservatives generally used. Tests gave no indication, with the exception of two instances, of added starch, or agar-agar or other gelatinizing matter. Attention was given to the colour and general appearance of the fruit products under examina-

tion, and the results of the investigation may be summarized as follows:—

Found adulterated with other fruit ...	2
Good colour and appearance	121
Fair appearance	8
Colour somewhat indifferent	7
Adulterated with starch, agar-agar, etc. ...	2
Preservatives used	nil

With respect to the second quality jams, the added fruits were found to be composed of either apple, pear, plum or quince. Three samples only, out of the 56 examined, were found to contain preservative. The results of the examination may be summarized as follows:—

JAMS CONTAINING BORIC ACID.

Diamond plum	4·0	grains to the lb.
Magnum Bonum ...	6·79	,, ,,
Raspberry and other fruits	8·45	,, ,,

THE OTHER ADDED FRUITS WERE

Pear	in 11	instances
Apple	,, 19	,,
Peach and Apple	,, 1	,,
Quince	,, 2	,,
Pear and Apple	,, 2	,,
Plum	,, 3	,,
Orange	,, 3	,,
Pear or Quince	,, 1	,,
Without added fruit	,, 14	,,
Total	56	samples

COLOUR AND APPEARANCE.

Good	in 8	samples
Fair	,, 11	,,
Dull	,, 18	,,
Inferior	,, 17	,,
Bad...	,, 2	,,
	56	

Metallic Contaminations.

Attention has been called in earlier reports, to the large quantities of zinc present in certain of our canned fruit products. Laboratory investigations traced the presence of this impurity to the soldering flux employed, and the want of care in washing the utensils before use. The quantitative determination of the various possible metallic contaminations is a lengthy and tedious process. The matter, however, appeared sufficiently important to justify the examination of a large number of samples. The following figures give the results of the zinc and tin determinations in different samples taken haphazard:—

MICRO-STRUCTURE OF JAMS.

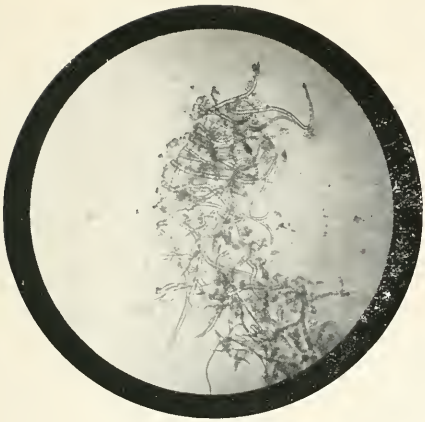


FIG. 1.—Hairs of Raspberry.

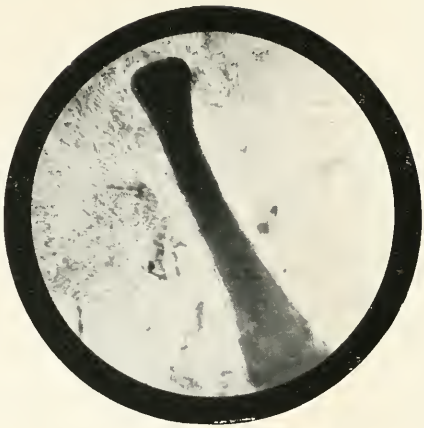


FIG. 2.—Hair Prickle of Gooseberry.

FIG. 3.—Seeds of Raspberry.

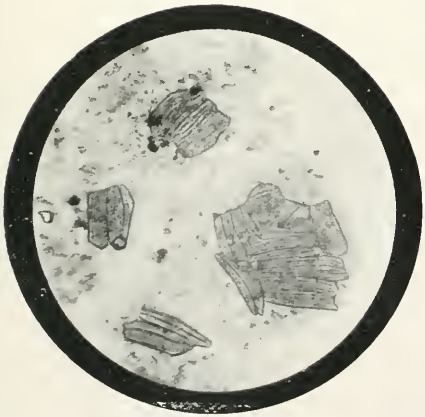


FIG. 4.—Compound Bodies in the Currant.

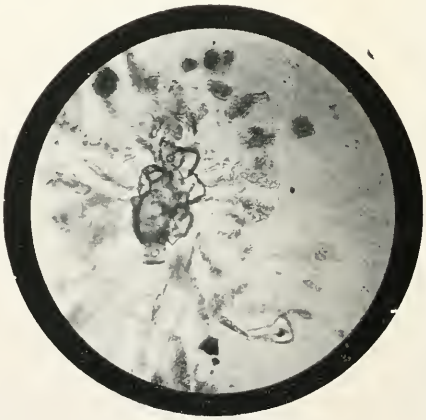


FIG. 5.—Sclerotic Tissue of Pear.

MICRO-STRUCTURE OF JAMS.

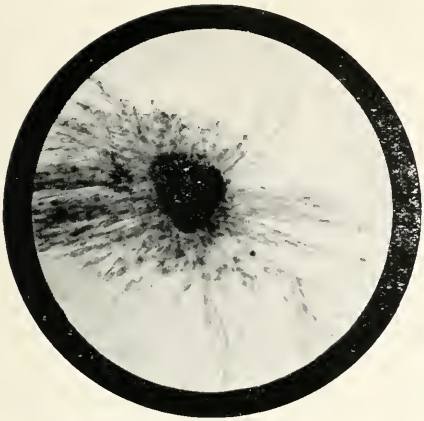


FIG. 6.—Sclerotic tissue of Quince.

FIG. 7.—Fibro-vascular tissue of Melon.

FIG. 8.—2. Seed of Blackberry. 3. Seed of Currant. 4. Seed of Gooseberry.

FIG. 9.—Fibro-vascular vessels of Apricot.

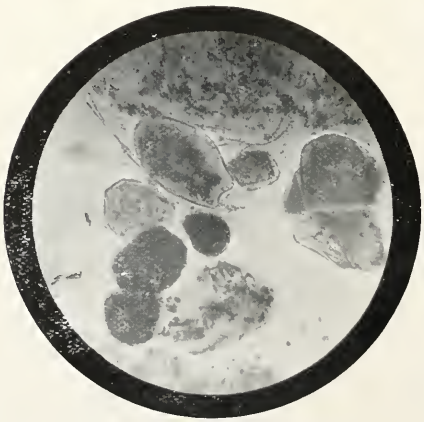


FIG. 10.—Fruit-pulp cells of Apple.

ZINC AND TIN IN SAMPLES OF JAM.

	Zinc.	Tin.		Zinc.	Tin.
	Grains per lb.			Grains per lb.	
Apple Jelly	3·92	—	Magnum Bonum ..	1·58	·07
Lemon & Melon ..	3·11	—	Plum	·28	·56
Raspberry	2·52	·56	Purple Gage	·49	·14
Raspberry	4·20	·35	Raspberry	2·38	·70
Golden Drop	·28	·21	Strawberry	3·50	·14
Gooseberry	3·50	—	Apple Jelly	3·78	—
Raspberry	3·22	·49	Black Currant ..	·63	·70
Yellow Gage	2·94	·35	Quince	2·52	—
Quince	1·82	—	Raspberry	6·02	·42
Apple Jelly	4·48	—	Orleans Plum	·56	—
Apple Jam	2·38	—	Cherry	4·20	·35
Gooseberry	·56	—	Purple Gage	1·05	·56
Golden Drop	·56	·28	Raspberry	6·37	·49
Peach	3·31	·21	Quince	4·20	—
Quince	3·50	—	Raspberry	6·58	·42
Raspberry	5·32	·21	Lemon and Melon ..	3·29	—
Ginger Pear	2·10	—	Quince	1·96	—
Lemon Conserve ..	·35	·42	Raspberry	1·47	·35
Plum	·56	—	Lemon and Melon ..	4·62	—
Quince	1·68	—	My Favourite ..	·77	·56
Raspberry and Gooseberry	6·16	21	Peach	·42	·28
Cape Gooseberry Jelly	4·06	—	Quince	2·80	—
Quince	4·20	—	Raspberry	2·80	·07
Raspberry and other fruits	1·40	—	Lemon and Melon ..	3·01	—
Fig	·77	·14	Black Currant ..	·56	·28
Gooseberry	4·48	—	Red Currant	4·90	—
Quince	2·52	—	Red Currant & Raspberry	3·36	·07
Apricot	5·60	—	Gooseberry	4·20	—
Gooseberry	5·04	—		58 samples	28 samples
Lemon and Melon ..	3·92	—	Average	2·87	·34

The average figures are below these obtained by Hilgard and Colby in a similar set of examinations carried out on certain canned Californian products. The advice given by Hilgard in his report may apply equally to Victorian canners. The quality of tin used, the composition of the solder, the methods of soldering and matters of cleanliness, are questions requiring serious attention on the part of all canners, either producing for local markets or preparing principally for export purposes.

The Examination of Fruit Pulps.

Samples of fruit pulps, representative of shipments forwarded to England, were sent in by Mr Knight, of the Department. The examination generally in this instance, covered the moisture content, presence of preservative, acidity, metallic contamination, protein and admixture with foreign fruit or vegetable pulps. The following table gives the results of the analysis of 25 different samples, together with the results of the examination of samples prepared in the laboratory.

ANALYSIS OF FRUIT PULPS.

Description of pulp.	For Shipment to EUROPE. Moisture.	Ash.	Total Acidity.	Nitrogen.	Zinc Grains per lb.	Prepared in the LABORATORY. Moisture.	Ash.	Total Acidity.	Nitrogen.	Ztnc Grains per lb.	Variety.
	%	%	%	%	%	%	%	%	%	%	%
Raspberry ..	87·87					86·87					Fillbasket
,, ..	89·23					84·73					Cuthbert.
,, ..	85·94					85·83					Smooth cane
,, ..	88·48					86·91					Common
,, ..	84·95	·52	1·11		23·04						
,, ..	88·17	·46	1·26		23·04						
,, ..	89·55	·53	1·25	·19	2·80						
,, ..	89·54	·47	1·15	·19	2·70						
,, ..	89·74	·46		·17	2·80						
,, ..	88·07	·52		·17	2·21						
,, ..	90·25	·47		·13	2·70						
,, ..	86·02	·66	1·07	·18	·007						
Average	88·15	·51	1·16	·17	7·412	86·08					
Gooseberry ..	90·46	·38	1·57		37·44	85·81	·50	1.00	.12		
,, ..	92·24	·70	1·24		trace						
,, ..	93·95	·38	1·77	·07	·005						
,, ..	89·56	·53	1·46	·12	·009						
Average	91·55	·49	1·50	·09	12·52	85·81	·50	1·00	.12		
Apricot	86·67	·80	1·02		14·40	86·92	·76	1·50	.15		
,, ...	81·91	·90	·93		37·45						
,, ...	82·54	1·25		1·6	3·30						
,, ...	88·76	·80		1·3	2 90						
,, ...	89·61	1·03	·75	1·7	·009						
Average	85·89	·95	·90	·15	11·58	86·92	·76	1.50	·15		
Black Currant ..	90·26	·74		·12	2·80						
,, ..	87·51	·66	1·26	·16	·017						
Average	88·88	·70	·63	·14	2·817						
Red Currant ..	85·62	·43	1·18	·23	·019	85·29	·63	1·30	·17		
Cape Gooseberry..	82·22	·70	1·01		34·56						

The most objectionable feature, as disclosed by analysis, is the excessive quantities of zinc present. This has been shown to be due solely to gross carelessness; and attention was called to the cause nearly two years ago. In a few cases, amounts of water in undesirable quantities appear to have been added. In expressing this view, however, attention is called to the fact that, with the exception of raspberry, one control sample only of the pure fruit has been taken for the determination of the moisture content. The work of this Branch

with regard to the determination of the moisture percentages, and the composition generally of all fruits likely to be exported in the pulped condition, will be resumed during the coming season.

Butters for Export.

Seventy-one samples of export butter, representing as many different factories, were sent in for analysis by Mr. Crowe. Forty eight of these samples were submitted to a detailed analysis with the view of determining general characteristics. The long time intervening between the date of a Victorian butter leaving the factory and being placed on the London market, suggests the necessity for other considerations than those obtaining, where the product is offered for consumption a few days, or a little more than a week after leaving the hands of the producer. A low percentage of curd is a point which perhaps, deserves special consideration in the case of Australian butters. In the following table, the moisture and boric acid content of 71 samples are given. In 48 samples of this number, the fat and curd in addition to this have been given. The soluble contents of the residue remaining after the extraction of fat, together with the insoluble ash, were also determined in 48 samples, and gave an average percentage of 1·88 and ·04 respectively. The results of the analysis of the product of the various factories placed in Mr. Crowe's hands the means of advising as to the faults observed, and suggesting necessary alterations to raise the standard of quality.

BUTTERS FOR EXPORT.

No. of Sample.	Name of Factory.	Moisture.	Fat.	Curd.	Boric Acid.
		%	%	%	%
11,837	Garvoc	10·94	85·83	·78	·328
11,838	Dumbalk	15·84	82·34	·57	·246
11,839	Geelong	10·54	86·08	1·24	·193
11,840	Alvie	10·20	86·75	·74	·177
11,841	Lake Boort	12·88	85·32	·36	·491
11,842	The Sisters	14·36	83·71	·48	·180
11,843	York	14·04	82·62	·71	·098
11,844	Wangaratta	13·75	82·63	·97	·099
11,845	Glengarry	10·64	85·45	·90	·099
11,846	Ruby	15·00	81·79	·49	·197
11,847	Farnham	13·18	85·30	·99	·098
11,848	Broken River	13·52	84·70	·53	·253
11,855	Mansfield	9·22	87·49	·51	·267
11,856	Warrenbayne	12·91	85·01	1·31	·143
11,857	Kyneton	13·61	84·91	·80	·352
11,858	Kilmore	13·89	84·23	·95	·403
11,859	Kyneton (Wattle Blossom) ..	10·92	86·23	·74	·223
11,860	Toongabbie	10·07	86·51	·92	·310
11,861	Lancefield	11·13	85·18	1·33	·309
11,862	Morwell	13·81	82·54	1·26	·323
11,863	Sale, Longford	12·48	84·13	·86	·679
11,864	Boolara, Haymens	12·92	83·15	1·38	·401
11,865	Mirboo North	13·10	83·27	1·07	·171
11,866	Broadford	13·56	84·08	1·26	·674
11,991	Acme	12·24	84·64	·62	·258
11,992	Appin	10·99	84·81	·66	·290
11,993	Drik Drik	10·67	85·49	·55	·380
11,994	Geelong South..	13·13	83·48	·64	·186
11,995	Maintongoon	12·19	84·02	·50	·294
11,996	Myrniong	14·51	81·97	·55	·400
11,997	Pyramid Hill	11·28	86·17	·78	·090

BUTTER FOR EXPORT (*Continued*).

No. of Sample.	Name of Factory.	Moisture.	Fat.	Curd.	Boric Acid.
		%	%	%	%
11,998	Rupertswood	15·48	80·13	·38	·475
11,999	The Sisters	14·53	83·87	·43	·461
12,000	Wallace and Millbrook	13·05	85·61	·37	·337
12,001	Yarram (Won Wron)	15·94	82·59	·45	·426
12,002	Yea	15·38	82·65	·73	·295
12,111	Alexandra	16·07	82·38	·54	·390
12,112	Beech Forest	11·69	85·68	·44	—
12,113	Corryong	13·85	84·80	·41	·253
12,114	Korumburra (Loch)	17·08	81·27	·60	·292
12,115	Korumburra	15·33	83·22	·44	·325
12,116	Lang Lang	14·46	83·18	·54	·154
12,117	Leongatha	14·93	83·72	·39	·585
12,118	Poowong	14·78	83·95	·48	·234
12,119	South Geelong..	16·66	80·80	·56	·119
12,120	Tallangatta	13·04	83·59	·38	·339
12,121	Won Wron No. 1	15·38	82·96	·71	·476
12,122	Won Wron No. 2	15·11	83·41	·51	·524
	Average of 48 samples ..	13·33	84·03	·70	·297
12,209	Caniambo	9·69			·204
12,210	Geelong (Dean's Marsh)	10·82			·172
12,211	Kerrisdale	11·74			·086
12,212	Kiewa Valley	12·30			·168
12,213	McArthur	10·63			·308
12,214	Meredith	13·45			·366
12,215	Orbost	10·11			·310
12,216	Portland	12·74			·030
12,217	Shepparton (Magpie)	11·20			·150
12,218	Swanpool	14·58			·511
12,219	South Eckling	14·59			·493
12,220	Yarrawonga	13·76			·202
12,282	Crossover	10·02			·192
12,283	Framlington	13·98			·404
12,284	Glenmaggie	12·20			·233
12,285	Merrigum	14·22			·327
12,286	Milawa	11·70			·323
12,287	Mincha	13·53			·464
12,288	Myrtleford	10·21			·129
12,289	Nathalia	14·45			·820
12,290	Springhurst	12·10			·376
12,291	Stony Creek	14·30			·252
12,292	Yannathan	12·94			·326
	Average of 71 samples ..	13·05			·297

An examination of these returns will disclose a water content in a number of cases above desirable limits. The boric acid content is also, in instances, above the allowable figures. For comparison with these butters, which were apparently selected owing to certain observed features suggesting faults, the following analysis of seven show butters from Traralgon have been included.

AGRICULTURAL SHOW BUTTERS.

—	Sample Marked No. 1.	Sample Marked No. 2.	Sample Marked No. 3.	Sample Marked No. 4.	Sample Marked No. 5.	Sample Marked No. 6.	Sample Marked No. 7.	Average of the 7 Samples.
	%	%	%	%	%	%	%	%
Moisture	12·24	11·77	11·79	15·30	14·80	12·52	10·45	12·69
Fat	83·95	84·46	81·69	81·40	81·83	83·82	85·93	83·29
Curd	·21	·22	·50	·38	·28	·40	·48	·35
Boric Acid	—	—	—	—	—	·45	·27	·10

The Adulteration of Honeys.

The most common adulterants of honey are glucose, cane sugar syrup, and the inverted cane sugar. The presence of glucose is a matter of easy detection. The detection of cane sugar presents also very little difficulty; but the question of an intentional addition as an adulteration is complicated by the absence of definite knowledge as to how much a genuine article should contain. The particular flora, and the artificial feeding of the bee are responsible for large variations in this direction, as evident in the composition of some of the Californian honeys. As invert sugar enters largely into the composition of a pure honey, the known limits of the quantities, naturally present in unadulterated samples, are the only sure guide to the expression of opinions as to the genuineness or otherwise of a sample in this direction. With respect to cane sugar, according to Wiley, it is a rare thing to find a genuine honey containing more than 4 per cent. of sucrose, but there are undoubted instances of pure honeys very considerably exceeding these figures. A sample of honey, supposed to be adulterated, was submitted to this laboratory for investigation by a gentleman engaged commercially with the article. The results of the examination indicated that an opinion might be freely given unfavorable to its purity. A number of other samples however submitted by the same gentlemen, and guaranteed as pure and unadulterated, gave in instances, returns corresponding closely with the supposed sample. According to Wiley's statement, a pure honey will rarely show, measured as degrees on a cane sugar scale with normal sugar weight, more than –20; although a greater number than this may not, he states, be conclusive of adulteration, it may well be looked at with suspicion. The results of the analysis of the samples sent in gave the following figures :—

HONEYS.

No. of Sample.	Description.	Polarization before inversion 23° C.	Polarization after inversion 23° C.	Moisture	Ash.	Acidity as Formic acid.
		%	%	%	%	%
12,650	Supposed adulterated	–22·0	–26·0	16·75	·08	·034
12,654	"B and B" supposed adulterated..	—19·25	—20·60	18·84	·07	·050
12,667	Apple Box, supposed pure ..	—2·3	—15·0	15·25	·05	·053
12,668	Yellow Box ,, ...	—23·3	—26·0	15·09	·10	·034
12,669	Grey Box ,, ...	—21·5	—25·9	13·42	·12	·034
12,670	White Ironbark, supposed pure ..	—16·4	—28·0	15·32	·13	·039
12,677	Yellow Box ,, ..	—20·3	—23·2	14·52	·07	·034
12,676	Sugar Syrup with honey.. ..	—5·6	–31·0	21·09	·11	·099

It is a usual practice, I believe, to feed bees at a certain time of the year with a partly inverted sugar syrup; although it is stated not for sale purposes. The production of the bee from such a food can not be regarded as a pure honey. This practice and certain unique conditions of flora and climate may explain, to a degree, certain characteristics of some of the samples sent in as pure; but the indications to my mind, are that certain samples which are accepted

commercially as unadulterated, are not so. The high acidity and traces, in two instances, of a certain acid, suggest the form sophistication may have taken. All the samples showed the presence of pollen grains. The matter appeared sufficiently important to justify attention being given to it, and the subject will be fully investigated at the appropriate period.

The Analysis of Stock Feeds.

A large number of stock feeds was submitted to examination, principally microscopic, for the detection of possible adulterations. These samples were obtained from manufacturers and importers, as well as in the open market. The microscopic examination revealed in instances, admixtures of materials of lower feeding value with the brans and pollards. In a sample of linseed meal sent in by a Geelong farmer, adulterations in the shape of rice husks were also determined. A chemical analysis of a number of more concentrated feeds was also carried out. The following figures give the result of the examination of the more important of these :—

	Average of 6 Samples Cocoanut Cake.	Average of 4 Samples Cotton Seed Cake.	Average of 2 Samples Cotton Seed Meal.	Average of 4 Samples Linseed Cake.
Moisture	11·65	8·90	8·80	9·86
Ash	5·61	5·60	5·64	5·66
Protein	18·90	45·82	45·44	29·36
Crude fibre	13·17	6·98	6·63	7·49
Nitrogen, free extract	40·27	24·27	23·16	33·66
Ether extract	10·40	8·44	10·33	13·97

				Proprietary Feeds Designated as—			
	Average of 4 Samples Wheat Bran.	Maize Bran.	Rye Bran.	Barley Meal.	Rice Meal.	Oat Meal Branning.	Pollard
Moisture	8·57	7·58	8·51	11·97	9·60	4·60	12·22
Ash	5·13	1·33	2·87	4·80	9·57	3·55	3·20
Protein	15·22	9·49	15.43	14·37	14·68	14·98	15·48
Crude fibre	9·40	—	—	7·81	6·76	17·22	3·63
Nitrogen free extract ..	58·08	—	—	56·06	40·51	51·87	60·81
Ether extract	3·60	4·20	2·13	4·99	18·88	7·98	4·66

The Analysis of Beet Samples.

Over 400 samples of beet grown on experimental forage fields were gathered for analysis. There were two plots of beet grown in each field, one where the roots stood in rows 18 inches apart and the other in rows 22 inches apart. There were three rows in each plot, but samples from the middle row only were taken for analysis. Each plot was divided into eight sections. Five of these sections in each plot received the following treatment :—

Beets Grown at 18 inches.	Beets grown at 22 inches.
Section A.—3 cwt. Ordinary Superphosphate per acre ..	The same.
,, B.— No manure	,,
,, C.—3 ,, Ordinary Superphosphate	,,
1½ ,, Nitrate of Soda	,,
,, D.—3 ,, Ordinary Superphosphate	,,
2/3 ,, Potash Sulphate	,,
,, E.— No manure	,,
,, F.—3 ,, Ordinary Superphosphate	,,
1½ ,, Nitrate of Soda	,,
2/3 ,, Potash Sulphate	,,
,, G.—3 ,, Ordinary Superphosphate	,,
1½ ,, Nitrate of Soda	,,
3 ,, Gypsum	,,
,, H.— No manure	,,

As roots were taken from every section for analysis, there were 16 samples analysed from each field. The object of the experiment was to determine the effect of manures and different distances of sowing on the yield, sugar percentage and purity of the crops. The results will require the treatment of a special report, but the following preliminary statement is of interest. The average weight of the topped root and the yield per acre from the 22-inch rows were heavier than from the 18-inch, but the sugar percentage and purity were higher from the 18-inch rows, not, however, to an extent precluding the possibility of growing the crop at the greater distance at practically the same returns, and at less cost for cultivation. Manures in both cases, taking the average of 16 fields, produced an increase in yield; the maximum increase being shown from the use of a complete manure. The sugar percentage, taking the average of the returns from the manured and unmanured sections, had also been affected favourably by fertilization. The purity also showed corresponding results.

The following figures express some of the analytical work :—

—	—	18 INS. BETWEEN ROWS.			22 INS. BETWEEN ROWS.		
		Yield of Dressed Roots.	Sugar in Root.	Purity.	Yield of Dressed Roots.	Sugar in Root.	Purity.
		Tons.	%	%	Tons.	%	%
Average of 16 fields ..	Manured section ..	14·27	17·47	86·09	15·90	17·01	85·42
	Unmanured section .	12·74	16·80	85·77	13·26	16·29	84·74
Mean	.. ..	13·50	17·13	85·93	14·58	16·65	85·08

The Analysis of Forage Crops.

The forage experiments for the year included tests with some 20 different crops, which it appeared advisable to analyse with the view of obtaining some idea of the comparative feeding values, in addition to the comparative yielding powers, which was the main object of the experiment. The attempt was made to secure plants from each class of crop in the same stage of maturity. Although great difficulty was experienced at times, in the carrying out of absolutely satisfactory work as far as the determination of moisture percentage was concerned, owing to the great distance from the laboratory at which the crops were grown, facts of value have followed the investigation, and will be more fully dealt with in the separate report on the result of forage experiments. The analysis of the millets and sorghums in the stages of maturity so far dealt with, on samples gathered from one field, gave the following results :—

ANALYSIS OF FORAGE CROPS.

I.—THE SORGHUMS.

Farmer.	Forage Crop.	Condition when cut.	Original Moisture.	Moisture of air dried sample.	Calculated to Original Moisture. Ash.	Protein.	Fibre.	Nitrogen free extract.	Fat.	Calculated to Water Free Substance. Ash.	Protein.	Fibre.	Nitrogen free extract.	Fat.
			%	%	%	%	%	%	%	%	%	%	%	%
Mr. Bott, Rosedale	Maize	Milky	79·35	14·57	1·19	1·46	5·74	11·80	·46	5·76	7·06	27·76	57·19	2·23
,,	White Branching Dhoura ..	,,	73·59	20·70	1·39	1·32	6·92	16·02	·76	5·26	5·00	26·20	60·64	2·90
,,	White Kaffir Corn	,,	77·16	16·76	1·47	1·63	6·83	12·14	·77	6·46	7·13	29·95	53·08	3·38
,,	Red ,, ,, ...	,,	77·53	17·58	1·39	1·74	6·82	11·84	·68	6·22	7·76	30·37	52·65	3·00
,,	Jerusalem,, ,, ...	,,	70·53	10·66	1·84	1·69	8·63	16·41	·90	6·26	5·74	29·28	55·65	3·07
,,	Early Amber Sugar Cane ..	Advanced Milky	69·67	14·01	1·53	2·03	7·65	18·27	·85	5·05	6·71	25·24	60·19	2·80
,,	Undendibule ,, ,, ..	,,	75·32	14·48	1·31	1·33	6·67	14·64	·79	5·31	5·40	26·79	59·31	3·19
,,	Yellow Branching Sorghum	,,	76·20	13·77	1·78	2·02	6·48	12·94	·58	7·46	8·50	27·23	54·38	2·43
,,	Sorghum Saccharatum ..	,,	74·02	13·30	1·46	1·69	7·28	14·83	·72	5·62	6·50	28·04	57·06	2·78
,,	Planter's Friend	,,	69·81	17·35	1·60	2·03	7·76	17·87	·93	5·30	6·74	25·73	59·14	3·09
,,	Broom Corn	,,	69·10	11·54	1·70	1·95	11·71	15·14	·40	5·51	6.43	37·77	49·01	1·28

II.—THE MILLETS.

Mr. Bott, Rosedale	White French	In Bloom Seed	83·30	9·83	1·57	2·14	4·69	7·87	·43	9·41	12·79	28·08	47·12	2·60
,,	Hungarian	Forming	64·22	8·77	3·47	4·89	9·01	17·03	1·38	9·69	13·65	25·19	47·60	3·87
,,	Japanese	In Bloom	82·11	10·98	2·27	2·94	7·33	10·14	·68	9·74	12·59	31·36	43·37	2·94
,,	German	,,	73·93	8·20	2·77	3·31	7·76	11·63	·60	10·64	12·71	29·77	44·55	2·33
,,	Red	,,	78·05	8·58	1·89	2·71	5·31	11·46	·58	8·62	12·37	24·17	52·17	2·67
,,	Brown	,,	79·67	8·85	1·62	2·79	5·84	9·50	·58	7·95	13·75	28·74	46·69	2·87

The discussion of these tables, as well as others obtained from the analysis of the same crops at different stages of maturity than those here given, will be more appropriately undertaken in the report dealing specially with the forage experiments. The analysis was made on the air-dried sample. The figures given as original moisture, represent the averages of a large number of plants.

Different Varieties of Mangolds.

There were five different varieties of mangolds in each forage field established. They were grown side by side and under the same conditions as the beet. The yields obtained from each variety, and the results of the full anaylsis, will be given in the report on the forage experiments at present in course of preparation. In addition to the full analysis, however, a number of separate sugar determinations was made of the dressed roots from each variety with the following results :—

Variety.	Weight of Dressed Root.		Loss due to Dressing.	Sugar in Root.			
	lbs.	ozs	ozs.				
Long Yellow	4	0	6·71	7·30 %	average of	9	samples
Yellow Tankard	4	10	5·85	6·27 %	,,	9	,,
Long Red	4	2	3·60	5·68 %	,,	9	,,
Red Globe	4	9	7·42	4·90 %	,,	7	,,
Yellow Globe	4	8	5·40	3·97 %	,,	7	,,

There were individual roots in which the sugar percentage of the Long Yellow and Yellow Tankard reached as much as 10 per cent. calculated on the weight of the dressed samples.

Insecticides and Fungicides.

A very exhaustive analysis was made in the preceding year of the insecticides and fungicides in use in the orchard and on the farm. There was then no indication that the materials in use were of a low standard of quality. Last year, a few samples of the latter only reached the laboratory. The seven bluestones sent in were of a good quality. The impurity as sulphate of iron contained in the different samples was as follows :—

SULPHATE OF IRON .. ·81 ·57 ·81 ·38 ·35 ·52 ·64

Two samples of formalin, however, sent in by an agricultural society, were of such a low standard as to be practically worthless for the prevention of smut. As the use of formalin is now largely replacing that of sulphate of copper as a pickle for cereals for the prevention of smut, it is very important that farmers should be certain, before using, of the quality of the material sold under this name. A good commercial sample ought to analyse from 30 to 40 per cent. of formaldehyde. The samples sent in contained a little over 2 per cent. only. Farmers are advised to send in samples freely to this laboratory for advice.

Remarks on the Analytical Work Generally.

Sufficient instances have been brought forward to indicate the scope and the lines of analytical work undertaken by this Branch. Contemplated legislation, with respect to the adulteration of foods, will of necessity increase the demands made upon the Branch in the future. There is at present in the laboratory a staff of young men trained to a specialization of work in this direction, and I take the opportunity here of bringing under notice the industry, enthusiasm, and ability which during the year have been strikingly apparent in one and all. My special thanks are due to my managing analyst, Mr. Scott, who by a rigid system of checks, constant supervision, and duplicate determinations by analysts working independently, has obtained the accuracy and thoroughness in manipulation, on the part of the juniors, which have so favourably influenced outside manure firms, that probably more than £100,000 worth of material is bought and sold, solely on the analysis of the Agricultural Chemist.

The analytical staff is made up of the following officers :—

Name.	Age.	Length of Service.	Classification.	Qualification.	Salary
P. R. Scott ..	40	16 yrs.	Supervising Analyst.	Student of Glasgow University under Professor Ferguson, and at Andersonian College under Professor Dittmar	£250
A. E. Creswell ..	36	12 ,,	Junior Analyst.	Trained as pupil at Agricultural Laboratory	£168
C. A. E. Price ..	43	5 ,,	Biological Assistant.	Assistant to Professors Martin & Halford prior to entering Laboratory	£150
R. M. Osborn ..	24	5 ,,	Junior Analyst.	Associate Bairnsdale School of Mines	£156
P. S. Garnsworthy	24	6 ,,	do.	Trained as pupil in Laboratory. Obtained highest honors in 3rd year chemistry at Technical School examination, 1902 ..	£100
W. E. C. Baudinet	21	4 ,,	do.	Associate Bairnsdale School of Mines	£95
W. C. Robertson ..	24	2½ ,,	do.	Student Bairnsdale School of Mines. Demonstrator for 16 months at School of Mines ..	£79
L. Bidstrup ..	20	2½ ,,	do.	Gold Medalist Dookie Agricultural College	£75
E. Trend	23	2¼ ,,	do.	Student Ballarat School of Mines, private assistant to Professor Mica Smith for two years ..	£75
H. Dowling ..	24	2¼ ,,	do.	Associate Ballarat School of Mines	£75
D. A. Runting ..	27	3 mths.	do.	,, ,, ,, ,,	£75
Geo. R. Cornell ..	19	3 ,,	do.	,, ,, ,, ,,	£70
R. Daly	19	2½ yrs.	Student Analyst.	In training Agricultural laboratory	£50
J. Watson	18	7 mths.	Pupil Analyst.	Receives no salary, being trained in Agricultural Laboratory ..	—

II. INVESTIGATIONS ON THE FIELD.

The experimental field tests formed an important part of the year's operations. They embraced fertilizer trials, forage crop experiments, and beet experiments from a sugar producing point of view. There were 97 hay and grain fields and 102 forage crop fields established on as many farms during the year. The fertilizer tests proper were confined to hay crops in the South, and grain crops in the North. The methods of conducting these co-operative tests, and the results, are given in Bulletin No. 13, which has just been published. The hay manuring tests covered a wide range of experiment ncluding :—

1. The effects of applications of phosphoric acid alone.
2. Of phosphoric acid and potash.
3. Of phosphoric acid and nitrogen.
4. Of phosphoric acid, nitrogen and potash.
5. The comparative effects of different forms of nitrogenous manures with phosphoric acid alone, and in combination with phosphoric acid and potash.
6. The effect of light, heavy and medium additions of a nitrogenous manure to medium dressings of superphosphate.
7. The effect of light applications of a nitrogenous manure to light applications of superphosphate.
8. The comparative effect of equal quantities of the three forms of phosphatic manure, viz., superphosphate, Thomas phosphate and bonedust.
9. The comparative effect of equal quantities of Thomas phosphate and superphosphate in combination with the two forms of nitrogen, and the two forms of potash.
10. The effect of equal quantities of sulphate of ammonia with the sulphate and chloride of potash.
11. The effect of equal quantities of the chloride of potash with nitrate of soda and sulphate of ammonia.

Forage Crop Experiments.

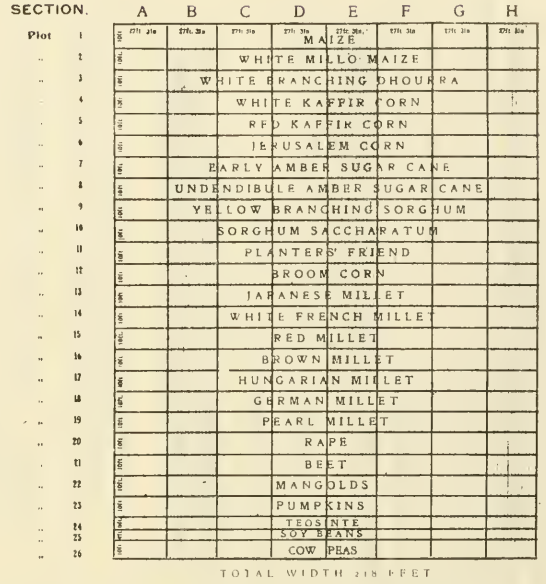
The forage crop experiments included trials with 26 different crops. The system will be explained by reference to the plan of the field.

PLAN OF EXPERIMENTAL FORAGE CROPS: 1903-4.

At the Farm of Mr. —

Names of Crops Sown.

No. of Plot	Name of Crop	No. of Rows in Plot	Distance between Rows FT	Distance between Rows IN	Width of Plot FEET
1	Maize	4	2	6	10
2	White Millo Maize	,,	,,		,,
3	White Branching Dhourra	,,	,,		,,
4	White Kaffir Corn	,,	,,		,,
5	Red Kaffir Corn	,,	,,		,,
6	Jerusalem Corn	,,	,,		,,
7	Earley Amber Sugar Cane	,,	,,		,,
8	Undendibule Amber Sugar Cane	,,	,,		,,
9	Yellow Branching Sorghum	,,	,,		,,
10	Sorghum Saccharatum	,,	,,		,,
11	Planters' Friend	,,	,,		,,
12	Broom Corn	,,	,,		,,
13	Japanese Millet	,,	,,		,,
14	White French Millet	,,	,,		,,
15	Red Millet	,,	,,		,,
16	Brown Millet	,,	,,		,,
17	Hungarian Millet	,,	,,		,,
18	German Millet	,,	,,		,,
19	Pearl Millet	,,	,,		,,
20	Rape	,,	,,		,,
21	Beet	3	0	18	10
		,,	0	22	
22	Mangolds: Mammoth Long Red	1	2	0	10
	Mammoth Long Yellow	,,	,,		
	Yellow Tankard	,,	,,		
	Monarch Yellow Globe	,,	,,		
	Champion Red Globe	,,	,,		
23	Pumpkins	1	,,		10
24	Teosinte	2	3	0	6
25	Soy Beans	,,	2	0	4
26	Cow Peas	5	2	0	10



The Plots as shown on the Plan are strips 218 feet long and 10 feet wide, with the exeption of Teosinte and Soy Beans which have a width of 6 and 4 feet respectively. On the Plan the Plots are shown as running from East to West and are numbered 1 to 26. Each plot is sown with a different kind of seed. Crossing the Plots at right angles are 5 manured and 3 unmanured bands all of equal width, viz. 27 feet 3 inches. These bands are marked A.B.C. up to H. The unshaded bands are those receiving manure. The shaded represent the portions on which no manures are to be used. The manures are to be carefully sown broadcast on the bands A.C.D.F. and G. and are harrowed in by passing from the top to the bottom of the field. The seeds are afterwards drilled in across the bands. Thus the manures are applied in this direction | and the seed on each plot drilled this way

FRED. J. HOWELL,
Chemist for Agriculture

It will be seen by the plan that the field also included a fertilizer test for each crop. The area naturally, is too small to give an absolutely correct idea of the yields which might be obtained under ordinary field practice. Taking the average, however, of the returns of the various sections of a large number of fields, valuable indications are obtained as to soil deficiencies and special crop requirements, and in this direction nothing more was expected from the experiment. The most valuable knowledge, however, which the experiments have furnished, is that of the wonderful adaptability of the soils of Southern Victoria to an extremely wide range of crops of great productive power. The dairyman has now in his power a selection which will provide a continuous supply of fodder, practically throughout the whole time he will need it. These results can only be properly dealt with in a separate report. The work has necessitated a great amount of labour, both in the field and office. Before sending out, the vitality of all seeds was tested and the weight of the bushel determined. The amount for each plot was accurately weighed, and the drill so adjusted as to complete the exhaustion of the seed box on reaching the last foot of the last row. The ground was well prepared before sowing, and manures carefully applied to line on the different sections. It was the weighing, however, which entailed the heaviest work. On a complete field there were 208 sections. The heavy crops on some of the plots necessitated as many as four and six separate weighings with the Avery scales to a single section. Each field officer engaged in this work was provided with a number of blank forms for filling in returns, and containing the directions to be observed. The following applies to some of the earlier maturing crops :—

RESULTS FROM EXPERIMENTAL FORAGE CROPS, (MILLETS AND RAPE).

Name of Crop.	Maximum Height of Crop.	Weight of Cut Portion from each Section.								No. of feet Harvested.	Remarks.
		A	B	C	D	E	F	G	H		
13.—Japanese Millet ..	.....	....	....	....	....	....	....	....	....	....	.....
14.—White French Millet	.....	....	....	....	....	....	....	....	....	....	.....
15.—Red Millet	.....	....	....	....	....	....	....	....	....	....	.....
16.—Brown Millet ..	.....	....	....	....	....	....	....	....	....	....	.....
17.—Hungarian Millet ..	.....	....	....	....	....	....	....	....	....	....	.....
18.—German Millet ..	.....	....	....	....	....	....	....	....	....	....	.....
19.—Pearl Millet ..	.....	....	....	....	....	....	....	....	....	....	.....
20.—Rape	.....	....	....	....	....	....	....	....	....	....	.....

DIRECTIONS TO BE OBSERVED IN WEIGHING.

The very greatest care is to be exercised in weighing, as the mistake of 1 lb. only in weight from such a small area would, calculated on the acre, give very great differences. The weight of the rope used in weighing is to be determined and allowed for. The crops are not to be cut until the dew has left them All the crops are to be cut at an equal distance as low down as possible from the ground, not portions high and others low. The cutting from each section is to be weighed immediately after cutting, and not left to lie for some time on the ground. Three rows are to be cut in each plot and the fourth left standing for seed, which will be harvested later on. This point must be brought under the notice of the farmer. Before cutting commences, the boundaries of the different sections, A, B, and so on, must be clearly defined by measurement and marked off by pegs. Should there be breaks in any of the rows, these must be accurately measured and the number of feet actually harvested given in the return. A report on any irregularity in the ground, or other cause affecting the yield of a particular section, must be given under the column remarks. A report must also be given as to other crops which will be worth harvesting later on, and the time about which they will be ready to harvest. Should any farmer object to cutting so much as three rows, representations must be made to him that the crops can be dried and make good hay, and that if cut a second and third crop will be obtained.

FRED. JNO. HOWELL, *Chemist for Agriculture, etc.*

The Quantity of Seed Sown and Germinating Power.

As the report on the results of the forage experiments will scarcely be out sufficiently early to assist the farmer sowing in the coming spring, the few facts at present available are given in this report. It is at all times advisable that the farmer before sowing, should test the germinating power of the seed he intends to use. This is easily carried out by keeping 100 seeds between moist flannel in a warm place, for a few days, and afterwards counting the number which has sprouted. The number will give the percentage. He will regulate the quantity he sows according to this percentage. The table below gives the quantity of seed of a high germinating power usually sown, the percentage of the germinating tests of the seed used in the experiments, the quantity of such seed used, and a few other facts. The yields of most of the crops sown under these conditions have not yet been worked out.

Plot in Plan.	Crop.	Seed High Germination Usually Sown.	Germination Test of Seed Used.	Quantity Sown Per Acre	Weight of Bushel In Lbs.
		lbs.	%	lbs.	lbs.
3	White Branching Dhoura ..	8	54	10	59
4	White Kaffir Corn	8	52	10	60
5	Red ,, ,, ...	8	88	8	61
6	Jerusalem Corn	8	84	8	59
7	Early Amber Sugar Cane.. ..	8	82	8	52
8	Undendibule Amber Sugar Cane ..	8	97	8	56
9	Yellow Branching Sorghum ..	8	46	10	56
10	Sorghum Saccharatum	8	91	8	$48\frac{3}{4}$
11	Planter's Friend	8	97	8	$52\frac{3}{4}$
12	Broom Corn	8	97	8	50
13	Japanese Millet	6	100	6	$38\frac{1}{4}$
14	White French Millet	6	99	6	$58\frac{11}{16}$
15	Red Millet	5	57	8	$58\frac{1}{4}$
16	Brown Millet	5	30	10	$59\frac{1}{4}$
17	Hungarian Millet	5	43	9	$55\frac{3}{4}$
18	German Millet	5	61	6	$55\frac{1}{4}$
19	Pearl Millet	4	80	5	$60\frac{3}{4}$
20	Rape	4	96	3	
21	Beet	12	100	12	
	Mangolds — Mammoth Long Red ..	4	92	4	
	Mangolds — ,, ,, Yellow ..	4	82	4	
22	Mangolds — Yellow Tankard ..	4	86	4	
	Mangolds — Monarch Yellow Globe ..	4	84	4	
	Mangolds — Champion Red Globe ..	4	90	4	

Distribution of Beet Seed.

In addition to the beet included in the forage fields, over 400 bags of sifted seed (mostly 12 lbs.) were sent out to farmers making application for supplies to test for fodder purposes. With each packet a circular letter was sent giving a few simple instructions for growing the crop. Towards the end of the summer, a second circular letter was forwarded to each applicant, asking for information as to whether the crop had succeeded, as well as for the opinion of the grower of the crop as a fodder. Accompanying this letter, prints of pulping and washing machines, for cleaning and slicing the roots, were also sent out. A copy of the instructions and letter is reproduced for the information of intending growers of the coming spring.

DIRECTIONS FOR GROWING BEET.

The Soil.

Any soil on which a good crop of maize or potatoes can be produced might be considered capable, under proper conditions, of producing a good crop of beet. The typical soil, however, may be described perhaps as a good sandy loam.

Manuring.

It is quite probable that most of our suitable soils contain as yet sufficient natural fertility for the production of a good beet crop. Should the use of manures be resorted to, nothing should be attempted without preliminary experiment should show the necessity of it, beyond the use of phosphatic manures only, such as superphosphate or Thomas phospate. Farmyard manure where used should not be applied directly to the beet crop, but may, if the soil requires it, be given to the preceding crop. It is not desirable to sow beet on freshly broken grass land; it might follow wheat or some other cereal crop.

The Preparation of the Ground.

The autumn preparation of the land for the beet, or the mangold, or carrot, is usually a ploughing to a depth of 8 or 9 inches, followed by a subsoiler which will loosen the soil to the depth of 6 or 7 inches more. At the present time it is not advised to go beyond ploughing deeply. The soil is then reduced to a perfect tilth. It is desirable that a final thorough scarifying of the ground should take place immediately before the sowing of the seed.

Planting of the Beets.

The beets may be either planted by hand or a small Planet Jr. or other hand drill. Where the drill is used it is usual to sow from 12 or 15 lbs.; in hand planting a less quantity will be found sufficient. The condition of the soil determines the depth of sowing the seed. In a dry soil with little probability of early rains, a depth of 1½ inches might be recommended, while half an inch would be found sufficient in a soil in a moist condition. The plants are afterwards thinned to eight inches apart in the rows. Wider planting produces a larger and coarser root, but one without the sugar purity and value of the smaller root.

Cultivation of the Crop.

The first cultivation should be commenced as soon as the beets are plainly discernible in the rows. The cultivation on small areas, up to a few acres, could be carried out by a small hand wheel hoe or by the ordinary hoe. The first cultivation is shallow.

Thinning of the Plants.

This is the most important operation in the growth of the crop. and to delay the work beyond the suitable stage in the life of the plant means in most cases the failure of the crop. The process of thinning should take place as soon as the beets show four (4) leaves, and after the first cultivation has been carried out. With the rows at 18 or 20 inches apart, a desirable distance for the best results, a strong plant should be left at every 8 or 10 inches.

The roots will probably show the maxfmum sugar percentage in February or March, according to the season and locality. In many localities the crop, if left in the ground through the winter, increases a great deal in weight, and consequently gives a very large bulk of fine fodder relished by all classes of stock.

The Trouble Involved in Growing the Crop.

The trouble involved in growing the crop is put forward as a serious objection, but such an objection is not well founded. The crop requires certainly some attention, and timely thinning and proper cultivation are essential to its success. A considerably better crop in feeding qualities than the mangold, the carrot, the turnip. and other root crops, its milk producing and fattening powers, fed under proper conditions, must sooner or later make it a warm favorite with our dairymen in a large portion of Victoria, and its many fine qualities will be found to more than compensate for the labor expended in its production.

FRED. JNO. HOWELL,
Chemist for Agriculture, etc.

Agricultural Laboratory,
440 Lonsdale Street, Melbourne.

CIRCULAR LETTER SENT PRIOR TO HARVESTING THE CROP.

AGRICULTURAL LABORATORY,
440 LONSDALE STREET,
MELBOURNE, *17th March, 1904.*

DEAR SIR,

I hope that the beet seed you received from me last spring has done well. I should naturally like to know the results of the experiment. Seed was sent out last year by me to more than 400 farmers. Inquiries are being daily received as to the treatment of the crop, etc., and as it is impossible for me to reply to each individual, I am forwarding you a few particulars by circular letter.

The beet should be now fit for feeding. The yellowing of the leaves will be the first indication of the crop having reached maturity. It is the practice of many of the Maffra growers to allow the crop to remain in the ground through the winter, pulling the roots as required. This practice appears to be adopted in preference to digging and storing. There is an increase in the weight of the crop, with in many seasons, not a sufficient decrease in the total sugar per acre to condemn the practice for feeding purposes.

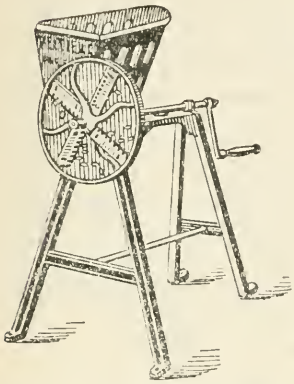
It is a mistake to think that the beet can be fed in very large quantities and exclusively to dairy cows. It is too fattening for that purpose, and would produce troubles in other directions. It should be fed in conjunction with some dry food. The practice of many of the experienced Maffra growers is to feed in a pulped condition in combination with chopped hay or straw. Much better results in the feeding of the roots will be obtained by giving in a pulped condition. The roots, owing to their large content of solid matter in comparison with the mangel, are hard on the teeth of the cattle, and are objectionable in other ways. A pulper or slicer costs little, and will be found to be a valuable adjunct on any dairy farm. I am forwarding reprints from a French work which will give an idea of the form of both a slicer and washing machine. It will be found essential to wash the beets before feeding to stock. In the early autumn this trouble might be avoided, but after the first autumn rains, the beet throws out a number of small fibrous roots, and certain soils adhere very badly to these. The washing machines are simple in construction and might be made on any farm. The principle in each case will be readily understood by examining the diagrams. A portable form is to be preferred as the roots can be readily moved to a position most convenient for washing. The stationary form is the simpler in construction, and consists of a perforated trough falling back on hinges in a tank partly filled with water. The beets are placed in the perforated portion, and after contact and stirring with water are tipped out by raising the handle of the trough.

This information is given to assist the farmer in the handling of a crop, which, while entailing a little more trouble in growth and preparation than the mangel, surpasses that crop considerably in its content of solid matter and nutritive value. With a few trivial adjustments, many of the objections raised to the adoption of the crop as a fodder will, I think, disappear. Fed with judgment all stock, especially pigs, will be found to do well on it. To lessen the cost of labor, ploughing out the roots instead of digging is advised.

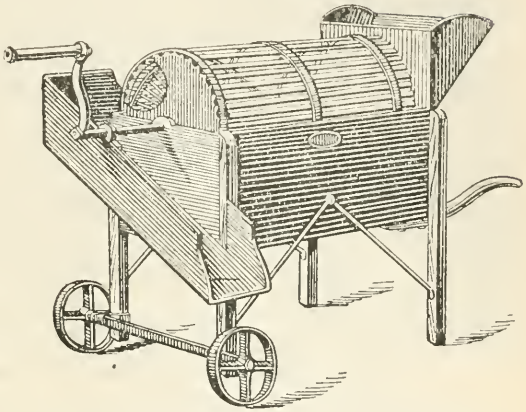
I should like to have your opinion on the beet as a food for stock.

FRED. JNO. HOWELL,
Chemist for Agriculture, etc.

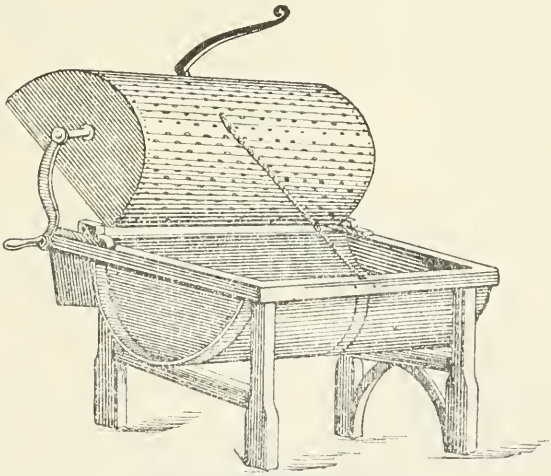
BEET SLICING AND WASHING MACHINES.



1. SLICING MACHINE.



2 PORTABLE WASHING MACHINE.



3. WASHING MACHINE.

The Collection of Soil Samples.

Field officers received instructions to take samples of soil and subsoil from the unmanured plots of all fields established during the year. The soils have been taken for the purpose of chemical and mechanical analysis. It is thought that this co-ordination of field experiments with laboratory investigations will in time afford data for expressing definite opinions as to the manurial requirements and adaptabilities of soils, where at the present we are at times, limited to conjecture. The following instructions, practically in Whitney's words, were furnished to each officer :—

DIRECTIONS FOR TAKING SAMPLES OF SOIL.

Having selected the spot in conformity with the instructions conveyed in the accompanying letter for collecting the samples with a spade, remove all grass, leaves or litter from the surface, and dig a hole like a post hole 24 inches deep. Scrape the sides clean, and notice the depth at which the change of color occurs between the soil and subsoil. Take a sample of the soil above this by cutting off a slice of soil down to the change of color about 6 or 8 lbs., and mix this thoroughly together. Fill one of the small bags with this well mixed soil, tie it securely and label it with such information as will serve to identify it when it is received in the laboratory. Then clean out the hole again, and scrape the sides so as to get rid of every particle of the top soil, and take a sample of the subsoil in like manner by cutting down a slice of the subsoil and thoroughly mixing it together, so that the sample shall contain particles of the subsoil from immediately below the top soil to a depth of at least 24 inches Put the sample of subsoil into a separate bag, tie it securely and label it. If there is no apparent difference between the soil and subsoil, take a sample of the soil nevertheless to a depth of 6 inches from the surface, and a sample of the subsoil from below this to a depth of 24 inches, and put them in separate bags as above. If the character of the subsoil materially changes before the depth of 24 inches is reached, a separate sample of this changed material should be taken, and the depth noted at which the change occurs.

The Officers engaged in the Field Work.

The field officers engaged in the work have left a good name behind them at the farms co-operating in the experiments. They have carried their duties out conscientionsly, and have shown zeal and industry in all their actions. I recognise how greatly the success of such work depends upon the tact and general conduct of officers towards the farmers they are brought into frequent contact with. The officers engaged in the work were :—

T. J. Castle	Geo. Swift	W. M. Jones
E. S. Hill	P. R. Whelan	Wm. Dowie
A. J. Whelan	D. Hutson	
Jas. Robb	H. Winne	

In addition to these officers my young laboratory assistant, Mr. Leslie Bidstrup, carried through the duties of an independent field officer, and was at times allotted a directing supervisory power over the work of the officers. The necessity of a scientifically trained man to directly supervise certain phases of the field work has been recognised by me, and Mr. Bidstrup entered the field with a view of securing a training in field operations in addition to his knowledge of laboratory practices.

III. THE EDUCATIONAL WORK OF THE BRANCH.

The expansion of the educational activities of the Branch during the year has been a most marked one. This has principally been due to the prominent part my officers have taken in the short agricultural classes initiated by the Director. 201 lectures have been given by officers of the Branch during the year, and engagements at present entered into will necessitate the delivery of 103 more prior to the end of September. Seven centres have been visited, and a course of agricultural lectures given, extending over a month in each.

The officers engaged in this work during the year from the Agricultural Laboratory were :—

F. E. Lee	C. A. E. Price	H. Dowling
R. M. Osborn	W. C. Robertson	E. Trend
P. S. Garnsworthy		

Mr. Lee has, in addition to 74 lectures delivered at the classes, given 40 addresses before many different Horticultural and Agricultural Societies. The Director placed the supervision of the classes in my hands. The management of the classes in the different centres was allotted by me to Mr. Lee, and after his departure from each centre, the same duties during the last half of the course were performed by Mr. Robertson. Both of these officers have by great tact in their dealings, and unremitting interest in their duties, secured an all round good opinion. Mr. Lee had found his opportunity in the preceding year for establishing his position with the farmer and the colleagues he worked with. The present year has seen Mr. Robertson's success in a similar direction. The able services of other well known officers of the Department without my Branch, as well as specialists from outside institutions, are a matter for comment from the Director and will receive consideration from his hands. A special report on the classes as a whole will be prepared by Mr. Lee.

The Creation of an Instructional Class.

The heavy demands made upon the time of the officers of the Branch in carrying out these duties, has forced upon me the recognition of the necessity of forming a purely instructional division within the Branch; laboratory duties would not then be interfered with. A further development of the Director's idea, by extending the instruction to the farm itself, would render possible the continuous employment of such officers. The scheme has been put forward by the Director to have night fireside lectures at some well equipped farm house, at which the sons of neighbouring farmers might assemble for two or three hours during the evening. This would not interfere with the day work of the farm, and would thus obviate one of the objections sometimes put forward by farmers.

IV. THE CLERICAL DUTIES.

The heaviest work of the Branch has undoubtedly fallen upon the clerical staff. The scope of the work embraced by this report will convey some idea of the heavy duties of the clerical staff. There are two officers only for the performance of the whole of this work, which is increasing at a very rapid rate. The total outward papers last year numbered 11,825 as compared with 7,174 the preceding year. An increase of officers of the clerical staff, and better remuneration of the services of those at present engaged, can with justice be demanded. Mr. Hatton, and his assistant, Mr. Hassett, are both recommended for favorable consideration in this direction.

REPORT OF THE VEGETABLE PATHOLOGIST.

D. McAlpine.

Each succeeding year witnesses the continuous expansion of the work of this Branch, for while many investigations are being continued on the lines already laid down, fresh ground is constantly being broken in the direction of increasing the variety of our products, improving their quality and introducing the best and most recent methods for combating disease.

The details concerning many of these measures which tend to increase production and diminish losses have already been given in the *Journal* of the Department, so that it will only be necessary here to state the principal results of the year's operations.

I.—Experiments.

These have principally been conducted in connection with the various cereals and the grasses suitable for fodder, while such important diseases as rust, take-all and smut in wheat, black spot and bitter pit of the apple, have been specially dealt with.

Variety Tests.

Cereals.—A number of varieties of wheat, oats and malting barley, including the Garton varieties, were selected for further trial as the result of the previous season's tests. They were sown at Nagambie, Rutherglen, Leongatha and Port Fairy, the latter place being chosen mainly to test their rust-resisting qualities. As a result several were found sufficiently promising to be sown this season in one-acre plots, and of the Garton varieties there were retained among others:—New Era wheat, Abundance oat and a two-rowed and six-rowed malting barley.

Hops.—The Californian hop-sets imported last season and found to be suited to our conditions were also tried at Leongatha. Samples of the hops grown there have been submitted to a leading hop merchant, and he reports:—"I find them a good sample and fine strong quality hop. If picked at the proper time, that is when quite ripe, we venture to say they would produce a first-class and saleable sample of hops and a great improvement on the hops hitherto grown from Victorian and other plants."

Grasses for Fodder.

Some of our best native grasses are being cultivated and the seed of the well-known wallaby and kangaroo grasses have been saved, so that by means of well-selected and properly matured seed it may be possible to improve them.

The United States Department of Agriculture has also supplied a great variety of seeds of grasses and forage plants, and altogether about 100 varieties are being tested at Rutherglen, Leongatha and Port Fairy. Several seasons are required to test them thoroughly both as to their growth and their suitability for different districts, but so far Rhodes grass *(Chloris abyssinica)* may be mentioned as yielding abundant fodder and standing the summer heat and winter cold very well.

Treatment for Diseases.

Rust in Wheat.—Experiments have been continuously carried on for over 12 years, with the object of obtaining rust-resisting varieties by means of selection and crossing. One such wheat, Rerraf, was distributed to about 400 farmers and the great majority of them found it to possess this quality, while varieties grown alongside were badly rusted and the yield consequently diminished.

Take-all and White-heads in Wheat.—For over 50 years the cause of this disease has been the despair both of practical farmers and scientists in Australia, but it has now been conclusively proved to be due to a fungus *(Ophiobolus graminis)*. Experiments are now under way for testing the best methods of treatment, and a detailed plan of the various measures being tried was given in the last (July) issue of the *Journal*.

Stinking Smut.—Comparative experiments were made with several steeps for the seed, and formalin proved to be the simplest remedy. A leaflet has been issued giving full instructions as to treatment.

Black Spot of Apple and Pear.—In some fruit-growing districts the past season has been the worst experienced for many years, owing to the prevalence of this disease, brought on by the late spring and summer rains. But where spraying operations were properly carried out the success was very marked.

The life-history of the fungus has been carefully studied, because of its important bearing on the time of spraying, and it has been found that over 90 per cent. of the fruit may become infected even before the petals have all fallen. This shows, what has been fully borne out by experiment, that the first spraying with Bordeaux mixture should be given just as the first few blossoms begin to expand, and if this one spraying is thoroughly done, it is all that is required, except in a very wet summer. When a second spraying is given it should be applied just when the fruit has set; but with some varieties this second spraying has a tendency to burn the fruit unless done with the greatest care. In other parts of the world growers are recommended to spray as many as four or even more times, but the experience here proves that one spraying at the right time is generally enough, while more than two are quite unnecessary and needlessly expensive.

Bitter Pit.—Experiments with various manures and dressings have been carried out at Pakenham for the last two seasons on the Sturmer variety of apple, which is known to be liable to this disease, but in the absence of a definite development of the disease no satisfactory

conclusions could be drawn. The experiments are being repeated for a third season and also duplicated in another district.

Dr. Bull, Bacteriologist of the Melbourne University, reports as follows regarding specimens of apples affected with bitter pit sent to him for bacteriological examination :—"My examinations of apples forwarded on March 28th were largely of a negative character as regards the causal relationship of micro-organisms to the diseased portions. Microscopic examination failed to demonstrate the presence of any specific form of organism, and bacteria were for the most part very scanty. Very few organisms developed on gelatine plates, and those present were principally moulds and chromogenic air organisms. It may be of interest to note that the specimens of apples have been kept in a cool room at a temperature varying from 32 deg. to 45 deg. C. since March 28th (four months). On examining them this morning I found that most of them had completely softened and were covered with a copious growth of moulds, mainly *Penicillium glaucum.* Several of them, however, although in direct contact with rotten fruit and copiously powdered with mould spores from adjacent apples, were in a perfectly sound condition except for the presence of the original diseased spots. The noteworthy thing was that *the original disease had not progressed.* If the conditions were due to bacteria *per se,* it is extremely probable that under such favourable conditions for pathogenic action and re-infection all the apples would have been destroyed. The apples which survived were Jonathans and a large green apple with mottled red streaks (label lost). Several New York Pippins were fairly sound."

II.—Plant Diseases.

During the year, 1,179 specimens were received for investigation and report, not only from Victoria but from every other State of the Commonwealth. Most of these specimens are of such a nature that they require to be examined microscopically, and in addition a report furnished as to the best methods of checking the disease. This entails a large amount of correspondence, and the laboratory work involved is hardly appreciated by the grower. In connection with take-all alone, thousands of wheat-plants in all stages of disease had to be examined microscopically and then experiments carried out to prove that the fungus was the cause and not a consequence of disease. The diseased plants forwarded, represented every branch of the agricultural industry in its widest sense—farm, fruit, vine and market-garden crops—in addition to numerous native and ornamental plants. With a limited staff one can only devote special attention to the more important, and during the coming season potato diseases will be thoroughly investigated. New and improved varieties are being introduced, and treatment of the soil and the seed will be given for the principal potato diseases described in my last annual report.

III.—Publications.

In addition to the articles which have appeared in the *Journal,* bulletins have been issued in connection with "Take-all and White-

heads in Wheat," "Two New Fungi Parasitic on Scale Insects," and a leaflet on "Treatment of Bunt of Wheat and Smut of Barley." A new and revised edition of the bulletin on "Black Spot of the Apple" has been prepared, giving the latest experiments in spraying.

A work on the Rusts of Australia is now in the hands of the printer and will shortly appear.

The Linnean Society of New South Wales has continued the publication of "Australian Fungi, New or Unrecorded," and Decades III., IV., V., VI., VII., VIII. have been published.

IV.—Miscellaneous.

Distribution of Cereals.—Under instructions from the Director, who has taken the very practical method of introducing into general cultivation new and improved varieties of cereals by supplying quantities to applicants at cost price, I have attended to the distribution of the following varieties:—

Wheats.—	Garton's New Era	Wheats.—	Marshall's No. 3
	Rerraf		Early Para
	Bobs	Oats.—	Abundance
	Fan		Garton's No. 5
	Majestic	Barleys.—	Garton's No. 1
	Gluyas		Standwell
	Dart's Imperial		Eclipse
	Nhill Wheat		Brewer's Favorite

By this means it is hoped that by well selected seed and growing varieties which have been found by actual trial to be suited to the district, the standard of farming may be raised and the average yield of the State increased.

Nitrogen-fixing Bacteria.—A supply has been received from the U.S. Department of Agriculture, and it is being tested how far their addition to poor soils will affect the growth of leguminous crops and increase the yield.

Green-manuring.—The Sour Clover *(Melilotus indica)* imported from Arizona, U.S.A., has already been grown in the Goulburn Valley and gives indication of being a satisfactory winter-growing green manure for orchard purposes. It is being further tried this season at Rutherglen, among the vines as well as in the orchard, and promises to supply economically plenty of humus to the soil, which is the great want of our northern districts.

Journal of Agriculture.—The editing of this publication also devolves upon me, and necessarily much of the work in connection with it has to be done after the duties of the day have been attended to. There is plenty of scope for experimental and laboratory investigations of diseases of plants, apart altogether from such extraneous work as the *Journal* involves.

It only remains to state that my assistant, Mr. G. H. Robinson, still continues to devote his best energies to the work of this Branch, and in every department of its activity gives loyal and efficient aid.

REPORT OF THE ENTOMOLOGIST.

C. French, F.L.S., F.E.S.

In submitting my report for the past year I have the honour to state that the work in this branch is increasing rapidly, the past and present seasons being specially favourable to the development of insect pests of every description, the number of specimens sent to me for identification and report being largely on the increase.

Reports.

Reports on the following subjects have been furnished, viz.:—"San José Scale," "Mistletoe on Forest Trees," "Onion Diseases at Drysdale," "Banana Question," "South African Regulations," "St. John's Wort," "Caterpillars at Labour Colony and Elsewhere," "Proposed Dipping of Fruit-cases," "Codlin Moth," "Root-borer, etc.," "Prosecutions in Markets," and on a number of minor subjects.

Correspondence.

The correspondence connected with this branch, although much similar in point of matter to that of last year, is on the increase, no less than 4,283 letters having been entered in the letter-book, but this number does not include the whole of the official correspondence with the head office, much of the latter, for the sake of economy, not being recorded excepting in the copying book kept for the purpose, and the same degree of punctuality in replying to correspondence of all kinds is most rigorously observed, and friendly intercourse with fellow workers in many parts kept up with the usual mutual benefits.

Literary Work.

In literary work the principal has been the contributions by myself to the *Journal of Agriculture*, and only the fact of great pressure of work has prevented further contributions to this useful publication. I am pleased to say that the former edition of 9,000 copies of Part I. of my work on the *Destructive Insects of Victoria* has been exhausted, and a further edition of the same sanctioned by the Hon. the Minister of Agriculture. It is a matter of pleasure to myself that so large a number has, at a satisfactory price, been disposed of, also that the demand for Parts II. and III. is still good. The plates and a portion of the MSS. for Part IV. are well under way, and a large number of inquiries for these have already been made. Contributions have also been made to the Government Statist's Report for the year 1902, and will be continued.

Investigations and Experiments.

Through the kindness of Mr. Roeding, Fresno, California, a number of Blastophaga, or "Fig Wasps" were introduced for

purposes of caprification, but owing to some unfortunate blunder on the part of some one in America the parcel was detained, and when the insects reached me they were quite dead and decomposed. Mr. Roeding has kindly promised to send a further supply, so we may hope for a more successful venture.

The root-borer experiments have proved that trapping in itself is insufficient to stamp out this pest, and although a reward has been offered for the best means of exterminating the insects, no real practical solution of the trouble has as yet been brought under notice. The root-borer is one of our very worst pests, as for years the growers were unaware of the cause of the trouble, and when this was found out, in most cases, the badly affected trees were either dead or dying, the grubs in the roots being most difficult to treat successfully. This matter is receiving our best attention.

The grasshopper-fungus tests have been followed up, and my suggestion as to making a small charge for the material has made a large difference in the number of tubes applied for, the number of tubes sent out during the present year being 842, and the amount received for same £36 6s. So far the letters received as to the value of this important discovery continue to be most satisfactory. The tubes on the present occasion have all been prepared at the chemical laboratory over which Dr. Howell presides.

Experiments on the San José Scale with lime, sulphur and salt, are still being carried out. A new material placed on the market in the shape of "red oil" gives promise of excellent results.

The peach aphides, both kinds, have not been so bad as in former years, the constant treatment having had a very marked effect, the peach crop of last season having been an exceptionally heavy one.

I regret to say that the onion land in many parts of the rich Drysdale district has still resisted our efforts to free same from the eel-worm, although the experiments carried out demonstrated that the wire-worm and other pests of a caterpillar nature could be destroyed by means of gypsum, sulphate of iron and other materials. The experiments will be continued, and we trust with some success, as these valuable lands must be treated until rid of these pests.

Further experiments for the eradication of the St. John's Wort have been made, and now that a sum of money has been granted for the purpose, we hope to be able to state what we have found to be the cheapest and most effectual methods of treatment. It is satisfactory to know that this plant can be permanently destroyed by means of certain chemicals, and the publication of a pamphlet, with coloured plates and methods of treatment, has been authorized and is now in course of publication, this for broadcast circulation amongst country municipalities, farmers, graziers, State schools, etc. Dried specimens of the plant have been sent to most of the municipalities throughout the State.

Lectures upon various subjects have been delivered by the field members of the staff (inspectors under the Vegetation Diseases Act)

and have been well attended, one member of my staff having been selected by the Director as lecturer to the farmers.

Museum of Economic Entomology and Ornithology.

The valuable collections in connection with the above have been largely added to, much of the material by myself and assistant, also by the acquisition of small lots purchased, the principal of the specimens being 100 species of American Coccidæ or scale insects, as also some insect-destroying birds. The rearing by myself of the moths belonging to the caterpillar attacked by the singular fungus *(Cordyceps)* is one of the most important of entomological matters, as is also the discovery of a new scale-destroying fungus *(Microcera)* by my assistant, C. French, junr., the latter plant having been described by the Vegetable Pathologist.

Visits from 100 teachers in the Education Department, 60 Veterinary College pupils, the Science Society, and 50 members of the Field Naturalists' Club, help to show the increasing interest taken in practical work of this kind, as at most of these visits lecturettes were given, the nature course having now been established on a firm basis.

Library.

The latest additions to the library have been several of the valuable American reports as well as those of the other Australasian States and publications of the Linnean and other scientific societies. The publication by Professor Wallace, of Edinburgh, of the memoirs and correspondence of the late Miss Ormerod, whose writings are familiar to all entomologists of note throughout the world, will be hailed with pleasure by all workers in the line of which the late distinguished lady was so eminent an exponent, and owing to the liberality of the Department a copy has been added to the library of this branch.

Exhibitions.

Recognising the importance of making the work of this branch known throughout the State, showy and instructive collections have been sent to the following shows:—Royal Agricultural, Geelong, Nhill, Buln-Buln, Exhibition (Melbourne), Bendigo, etc. These exhibitions, which are under the supervision of Mr. J. Knight and his assistants, attracted large numbers of people, and now that a suitable building is to be erected for the purpose and the exhibits themselves largely added to, it is hoped that even much larger and better displays will in the future be forthcoming.

Vegetation Diseases Act.

The necessity for introducing some amendments in the above Act has been patent, the number of successful prosecutions of negligent growers having increased. The Act is being administered firmly, but owing to the past season being, as before stated, favourable to the

increase of both insect and fungus pests, a considerable amount of leniency has been exercised, especially in the case of fruits exposed for sale in markets and shops.

Inspection of Orchards, Nurseries and Gardens.

I regret having to report that for this work the number of inspectors is too few, one of the latter having resigned and another temporarily placed in charge of the operations connected with the eradication of the St. John's Wort, the latter being a work of grave importance; and in place of the inspector who has resigned, another has been appointed and is expected to shortly enter upon his new duties. At Mildura an inspector has been appointed and a portion of his salary contributed to by the Department of Agriculture; this new departure, owing to the extent and comparatively isolated position of the settlement being absolutely necessary.

Some indication of the extra work entailed upon the few inspectors may be gleaned from the fact that according to the Report of the Government Statist the area under orchards has increased at a rapid rate, and in 1902-3 consisted of 45,885 acres, the latter being the area of orchards cultivating fruit for sale, and in addition to the above there are no less than 5,976 acres laid down in private gardens growing fruit for home consumption.

Inspection of the nurseries still continues on a satisfactory basis, this being one of the most urgent portions of the inspectoral work. These nurseries are inspected every six months, and when found clean and free from disease are passed by the visiting inspector and a certificate to that effect given. The system of nursery examination has been very successful, especially in the United States, and it should be equally successful here. It is to be hoped that the other Australian States may soon follow our example, as it is in the nursery where the real danger lies, and it is from such places the distribution of the San José scale and other serious pests has invariably been traced. During the year 1,931 certificates have been issued by this branch, the number of packages of plants exported under our certificate being 3,637.

The work of destroying old and worn-out orchards, mostly relics of land boom times, continues and no pains will be spared to get rid of this nuisance, as well as menace to the grower, be he growing for sale or otherwise.

Fumigating and Treatment of Used Fruit-Cases.

Plants and cuttings coming into Victoria from foreign parts or from the other States are fumigated at the Burnley Gardens, that is if a certificate of same having been treated at the port of shipment does not accompany the consignment, and even then we reserve to ourselves the right of examination, and, if found necessary, insist upon the double fumigation. In the North-Eastern districts many

orange and lemon orchards have been treated by means of the cyanide gas, the tent being available to those applying for it. Owing, however, to the capricious changes in our climate, the results have not always been quite satisfactory.

The necessity for dipping, *i.e.*, scalding, used fruit-cases appears to be plainer than ever, as it is largely through the agency of these cases that the grubs of the codlin moth are distributed. The matter is under immediate consideration, the trouble being in working out a scheme for the proper treatment of a large number of cases with a minimum of inconvenience to the grower. Dipping the cases is of the greatest importance, but on a large scale extremely difficult, for the reasons before stated, to carry out in a practical manner. We hope shortly to be able to solve this question.

Miscellaneous Insect and Bird Troubles.

The grasshopper pest having been successfully tackled, it remains for this branch to devise some practical means for the suppression of the caterpillar plague so much dreaded by the farming community. These caterpillars, several kinds, have been treated in both book and pamphlet form. The trench system on large areas, and the food poisoning by means of arsenic, bran and treacle for small buildings have been tested and found to be quite satisfactory.

With regard to the probable introduction of "fruit flies," there appears to be a grave and increasing danger, no less than 14 larvae of the Mediterranean fruit-fly having been found in one Mandarin orange taken from one lot, which was promptly condemned. This consignment had been sent from Maryborough (Queensland) and had not been fumigated, and if it had been so treated the results would probably have been the same, as the cyanide would be unlikely to affect grubs inside any fruit.

Whilst on the subject of the fruit-flies especially, I desire to point out that the inspection here is as perfect as circumstances will permit, but that the said inspection will keep out the fruit-flies, the enemy to fruitgrowers most of all to be dreaded, is impossible, and I take this opportunity on behalf of myself and staff to point out this fact to the Department and to the fruit-growers of this State. There is but one of two evils, either to prohibit all citrus fruits and bananas, in fact all soft fruits, from certain outside sources, or to take the risk of introducing these pests into our State, and as I mentioned previously, this matter is of the gravest importance and should have the best consideration of all concerned. As showing the importance of our banana and orange imports, it may be mentioned that during the past year the value of the former was no less a sum than £81,700, and of the latter £68,000, this being the lowest estimated value.

The arrival of an enormous quantity of rice, 136,586 sacks, badly infested with the larvae of the "dried-flour moth" *(Ephestia kuhiniella)*, has given us some concern, but as this rice is to be converted into starch we have allowed it to be treated under our supervision.

The grain sent from India and other countries is very dirty, and should be fumigated at the port of shipment. This is important.

The English starlings, after having driven off most of the small insect-eating birds, are increasing with extraordinary rapidity, and if some prompt and decisive measures for their destruction be not soon taken the fruit-grower has a serious time before him. I consider it my duty, as one in charge of the branch, to draw attention to this matter, which is of great urgency.

Examination of Imports and Exports of Fruit, Plants and Grain.

In the table devoted to imports, and compiled by Inspector Turner who is in charge, it will be seen that no less than 653,639 bunches of bananas were imported during the year, out of which number 59,849 bunches were condemned either on account of the presence of fruit-fly larvae or as having become heated on the voyage, the refuse being either towed outside the Heads by means of barges or given to the cow-keepers, who have, under our supervision, to steam all fruit before carting away.

The following report of Inspector Turner will furnish a correct idea of the amount of fruit inspected and of the large amount of clerical work involved thereby :—

IMPORTS AND EXPORTS OF FRUIT, PLANTS AND GRAIN.

Inspector Turner reports :—The returns for the year ending June 30th (see under Statistics), compared with the previous year, show an increase in the amount of fruit, plants and grain inspected under the Vegetation Diseases Act and a falling off in the number of packages from extra Australasian ports. This is satisfactory enough, but the large decrease in the number of packages exported from Victoria, nearly 200,000, requires explanation. This decrease may be attributed to two causes, the first being the severe drought of the preceding year and the second the imposition of a charge for the services of the inspectors. When this fee, charged upon exports only, was imposed exporters immediately ceased to call for inspection and their products were sent away without the usual certificates. The work of the inspectors was then confined to such fruit as was sent to the ports where a certificate is necessary. This has involved extra clerical work, which, added to the particularly heavy amount of supervision over disposal of condemned fruit, has taken up the time lost. The export of fruit to London was considerably lessened by the hailstorms of the early part of the season and the keen competition of the Canadian stored apples. A serious falling off in the South African trade demands investigation; the number of cases sent there last year (1903) amounted to 15,250 cases, while this year the number was only 440 cases.

The announcement that the Government has set aside a sum for the erection of a shed at Port Melbourne for the protection of fruit for export should give satisfaction to those exporters who have suffered long from the effects of exposure to weather and pillage.

Other matters, such as the proposal to erect a plant for treating second-hand fruit-cases, the results of prosecutions for offences against the Vegetation Diseases Act., etc., are dealt with elsewhere by Mr. French.

It is my pleasurable duty to thank those who have again contributed to either the library or the museum, also those of the inspectors who have assisted in field work, by lectures and experiments.

REPORT OF THE CHIEF INSPECTOR OF STOCK.

J. R. Weir.

As will be seen by attached reports received from the various district inspectors and summaries of the various officers on the border stations, the prospect from an agricultural and pastoral point of view is decidedly bright and cheerful. From no single source comes a disheartening statement, all bear witness that a record season is in store. Truly the prospect of such a season cannot bring back to life the bleached carcases of those poor animals which perished during the ill-fated years which we have passed through. The dominant note from all quarters is that the land is understocked, but this will have its compensating benefits, as the surviving animals will have the choicest of pasturage on which to recoup their strength, and the young stock, in addition to being the progeny of hardy animals, will be enabled to build up strong, hardy, sturdy frames from their having abundance of choice feed. The grass lands will profit by the light stocking, as a great deal of the herbage will have had a chance to seed, and thus replenish after the severe trial which had been imposed upon it.

Horses seem to have been particularly free from disease, but few cases of stringhalt have been recorded. In some localities, strangles assumed a malignant form, but the losses were few.

Cattle.

It is to be noted with pleasure that our herds are, taken as a whole, showing a decrease in the number affected with tuberculosis, and this, too, despite the heavy strain dairy animals have upon them in producing milk There appears a desire on the part of dairymen to improve the system of management, by studying the comfort of their animals. This all tends to improve the health of the animal and the wealth of its owner. As might be expected, there were but few cases of actinomycosis recorded, and when the case was an aggravated one the animal was destroyed. Of anthrax only two cases were recorded during the past half-year, and twenty-two cases of pleuro-pneumonia, all of which were confined to one class of country. When delay was experienced in stamping out an outbreak, it was due to the fact that improper virus was used; at present all seems well, as no outbreak has been reported for some time. But few cases of impaction have been reported. From a few quarters cripples are reported—pasture deficiences and close breeding are the important factors which tend to produce this condition.

Sheep.

There have been a few reports received of trouble among sheep, which, upon investigation, have been traced to fluke and hydræmia—

liver rot. With a summer such as the past, this is not to be wondered at, and the absence of these worries among their flocks for a few years had caused some owners to think they were a thing of the past; while to others it came as a revelation to find their pastures were the cause. In connection with fluke, Dr. Cobb, of the N.S.W. Department of Agriculture, favours the assistance obtained from ducks or other birds which devour the host, which the fluke inhabits in an intermediary stage after passing from one sheep in the form of ova, before they are taken up in the larval form on the pasture by other sheep. This would no doubt be a very simple and efficacious method of destroying a number, but owners should place licks, containing salt, sulphate of iron and lime, in different parts of the paddocks in which the animals are grazing so that they could have free access to them at any time. This would at least prevent either fluke or water rot obtaining mastery over the animals. Maggot fly has caused some trouble to ewes in the Swan Hill district, as also on some parts of the South Australian border; from which latter locality weaners are also reported as suffering from worms.

Swine.

As will be seen by reference to the reports of the district inspectors, swine fever has again manifested itself. Fortunately, however, while the losses have been very severe on some places where the disease existed last year, the various inspectors have been enabled to keep it in hand, and thus preventing its spread by restricting the movements of the pigs from such places and the enforcement of strict quarantine on the piggeries. In connection with the stamping out of this disease, Mr. Cother pays a deserved compliment to those salesmen in the Western district, who absolutely refused to allow store pigs in their yards unless they were able to vouch for their health; from Warrnambool comes similar news. In fact store pigs would not be yarded, while from Ballarat comes a message of similar import. This shows a genuine feeling on the part of these gentlemen to assist the Department in its efforts to stamp out the disease. Were owners themselves animated by a similar desire the rest would be easy, but as it too often happens, when a pig dies on the premises of many of them, no time is lost in putting the others into the market, so that some one else may lose money by purchasing that which the vendor knows is diseased.

Reports.

The various district and border inspectors of stock report as follows:—

Warrnambool District.

Mr. Haines reports:—During the last six months I have been engaged in inspecting and quarantining cattle for pleuro-pneumonia; inspecting pigs and dairy and other cattle in various portions of my district, in part of which anthrax was supposed to have broken out, but which on investigation proved without foundation. I have

further made diligent enquiry *re* the number of remount horses likely to be available for army purposes.

The dairy cattle inspected numbered 29,307, and of these three were slaughtered and three isolated for disease. Of cattle other than dairy 14,469 were inspected, of which five were found diseased, three were isolated, and two slaughtered. No poultry tick exists in my district. During the past six months, I am happy to state, my district has been almost free of disease in stock other than pigs—an outbreak of swine fever occurred in April, but owing to strict inspection and quarantine of premises being effected, and no store pigs being brought into market, thus preventing movements from farm to farm, the disease is nearly at an end. No cases have been found or reported for nearly a month. Tuberculosis and actinomycosis seem to be getting less prevalent, owing in a great measure to more care, and destruction of affected animals by owners, and to a better class of cattle being used for dairy purposes, together with the exercise of better judgment in the selection of the bulls. Rickets and cripples are still bad on my western border. Abortion has been prevalent in some dairy herds near Warrnambool, but the usual antiseptic precautions when adopted, appear to have stopped it. But one outbreak of pleuro-pneumonia occurred during the past six months; this was in some Queensland bred animals, the disease developing shortly after their arrival in the district, and twelve died. The remainder of the mob were inoculated, and no further deaths occurred. The owner is of opinion these cattle contracted the disease through the medium of the railway trucks in which they were carried in South Australia.

The best favoured breed of dairy cattle in this district seems to be a cross between the milking strain of Shorthorn with the Jersey or Ayrshire; pure Jerseys seem too delicate for this climate. The average yield of milk per cow is 400 gallons per annum.

Plenty of rain has fallen, store stock are in good condition, and there is every prospect for stock unless exceptionally cold weather sets in. The country being understocked, feed is abundant. The best native grass on the cattle stations appears to be kangaroo grass. Artificial grasses adapted with best results are: Rye grass and clover for good rich land, and cocksfoot for rough hilly country.

Among sheep but few deaths are reported, and all inspected seemed very healthy. Lambing returns good, although in some localities spells of very cold weather killed a good many young lambs. Dips containing arsenic, mixed with soft soap or pearl ash, considered best as they destroy the ova as well as the ticks or lice. Lucerne in the opinion of many owners is considered to prevent impaction in dry seasons, hence it is much favoured as a summer food. Irrigation is not practised in this district.

The last outbreak of swine fever in this district was of a very virulent form.

Geelong District.

Mr. Cother reports:—The latter part of the past summer was exceptionally moist, consequently instead of the grass dying off, as

usual in most of the Western district, it remained green until autumn. Notwithstanding the abundant supply, graziers are of opinion that it has not been so nutritious as in normal seasons, which, I think, may be attributed to the excessive moisture having forced the growth. The grass may be said to be water-grown, and hence lacking in the nutritive properties that it would have if the usual process of spring growth and summer ripening had taken place. Although such a season appears to be beneficial, it may be at the expense of the following year, in that the forced and weakened growth results in seed deficient in germinating power. This, with the failure of the autumn rains and sudden advent of severe cold, has clouded the prospects for the winter. Fortunately for graziers, however, hay is plentiful and cheap and stock can be hand-fed cheaply, creating a demand that will be very acceptable to the numerous holders of large stacks of hay.

Stock generally are in good condition and remarkably free from disease. Fat cattle are plentiful and cheap for this time of the year. Sheep remain at a high price and are not likely to come down, although the demand for store sheep has slackened lately, the uncertainty of the season probably being the cause.

The past summer has been a remarkably good one for the growth of fodder crops, maize especially, samples of which have been exhibited reaching to a height of 12 feet.

Actinomycosis, contrary to my expectations, has not been so prevalent, due probably to the barley grass not ripening as in normal seasons.

It is my pleasing duty to report a great falling off in the number of cases of pleuro-pneumonia in the Western district, which have been so few that it may be said to have been almost extinct.

The herds continue to show a diminution in the number of cases of tuberculosis also, it being a rare thing to see an advanced case.

Three localities have been visited with outbreaks of anthrax this year, the source of infection in each instance being obscure. None of the farms previously affected have had a recurrence, a result mainly due to the measures taken to stamp out the disease.

Lung-worm in sheep has given some trouble, but ticks and lice have not been so much in evidence. Stringhalt has not been very troublesome, a few isolated cases only coming under my notice.

Exercising vigilance in preventing the spread of swine fever has occupied most of my time of late. There has been no recrudesence of the trouble at any of the originally infected farms, and those cases that have occurred were introduced from other districts. I am certain of getting it under control if no "foreign" pigs (as they are called in the Western district) are brought into the district, and to prevent their coming, if possible, the salesmen are refusing to offer any but local pigs in their yards. I think it is but due to them to acknowledge the support they have given me in my efforts to prevent the spread of disease generally. I am sorry that I cannot say the same

of dairy farmers, some of whom recently, in connection with an outbreak of anthrax, went so far as to denounce the local inspector and sought to have him removed from office, and tried to organize a public indignation meeting with that object, on the ground that the disease having been declared to be anthrax would injure the district. Fortunately their efforts failed to have the intended effect of removing an efficient officer or of influencing the councillors against him, as they recognized his value to the district.

Inspections made during the half-year to June 30th were :—

Cattle.—7,145 head, of which 509 were milking. Of the number inspected 3 were found affected with tuberculosis and slaughtered, whilst 8 others were isolated.

Sheep.—68,267 were inspected.

Swine.—14,469 were inspected, 11 of which were found diseased and destroyed.

Central District.—Eastern and Southern Portions.

Mr. Lawler reports :—My duties for the half-year ending June 30th were for the most part inspection of stock on farms, market and special stock sales, during the currency of which period I inspected 26,914 cattle, included in which were 9,864 dairy cows. Amongst these I found 60 animals affected ; 22 were suffering from pleuro-pneumonia, 29 with tuberculosis, and 9 with actinomycosis. Of these 22 were slaughtered for pleuro-pneumonia and 25 for tuberculosis, making a total of 47, the balance (13) being isolated.

A pleasing feature during the above period was the abundance of feed on every side ; against this, however, it must be borne in mind the country is very much understocked, as I have noticed many large paddocks, heavily grassed, with not a beast in them. This is but another reminder of the drought which broke up 15 months ago, through which many owners lost not only their stock but their crops also, and they have not yet been able to re-stock, and the few stock such persons hold are in consequence in the pink of condition.

There has been but one case of anthrax in my district during this half-year, which was fortunately stamped out with but small loss to the owner, and never extended beyond the one farm. Tuberculosis and actinomycosis are on the decrease, as were also instances of impaction and cancerous growths. There was, however, a marked increase in the cases of pleuro-pneumonia, though it is noticeable that this disease was restricted in its ravages to one type of country, viz., steamy river flats enclosed by mountains. In six of these cases inoculation with good virus sufficed to stamp out the disease at once. In another there was greater difficulty experienced in contending with the disease, whilst in another instructions were not carried out. The first inoculation was performed with a useless substitute for virus, with results as might be expected. A second attempt was similarly fated through inattention to the operation, and several weeks passed before they were again operated on, with satisfactory results.

I have repeatedly striven to impress on landholders in the northern areas the great injustice they were committing on their animals by not planting hedges, which would act as a shelter and breakwind during the winter's cold and summer's heat. Too often the straw-stacks were also burnt out of the way, and it seemed as if nothing would make them depart from their old habits. I note with pleasure this year they have acted wisely in saving their straw-stacks for the stock to camp round during the extreme cold of winter.

Central District.—Western Portion.

Mr. Parfitt reports :—The stock in my portion of the Central and Goulburn Valley districts are in a very healthy condition, owing probably to the severe droughts they have just passed through having killed off all but the healthiest animals.

Dairies throughout my district are in a sanitary state. There have been no outbreaks of pleuro-pneumonia during the past half-year, nor of anthrax for such period.

Lambing averages are exceptionally good; farmers' lots will average about 90 per cent., larger flocks 80 to 85 per cent.

Irrigation is carried on extensively in parts of the Goulburn Valley, and lucerne grown with great success.

The early summer rains caused a new growth in the grass in January and February, but the moisture not continuing the autumn sun soon dried it up, consequently we have have had a bad autumn for grass.

Cattle inspected, including 3,570 dairy, 38,631, of which number 38 were destroyed for tuberculosis and one for actinomycosis.

North Gippsland District.

Mr. Corney reports :—I have inspected 29,230 cattle, 30,000 sheep, and 7,861 pigs in all in the various portions of my district which I have visited, and regret to have to report a number of cases of pleuro-pneumonia, outbreaks having occurred at eight centres, ten holdings being affected. There were many deaths prior to quarantine and inoculation, but this joint restriction and remedial agency has proved effective in checking the spread of disease. I have had sixteen animals destroyed for tuberculosis, and ten for actinomycosis in an aggravated form. Swine fever made its appearance in two centres, and several owners suffered considerable loss, six of whom have had their properties quarantined, and the precautions adopted by them seem to have checked the progress of the disease, as no deaths have occurred on these holdings since.

Apart, however, from the cases cited, the stock in the district are very healthy, the season has been particularly favourable, the grass remaining green throughout the summer, consequently cattle are in better than average condition for this time of year. Sheep are scarce; cattle breeding stations being now well nigh all broken up, and dairying extensively carried on. It is gratifying to find dairy-

men using a better class of bull than was formerly their wont, besides paying more attention to the comfort of the calves. No doubt the high prices ruling within the past few years have been the reason, and graziers, having to replenish their herds with steers from dairy farms, insist upon having a better class of animal for fattening purposes.

Horse breeding on anything like an extensive scale has been abandoned, and they are now bred from one or two up to about twenty by farmers and dairymen, so that it is impossible to estimate what number are likely to be bred or what class they are likely to be. The heavier sorts are most popular at the present time, and owners are trying various means of breeding the low strong-boned animals so much in demand for export. Active draught stallions are used with thick-set blood mares, thick-set blood stallions with medium draught mares, and 14-hand pony stallions with crossbred mares of the delivery sort.

Pig breeding is carried on very extensively and successfully, especially in the Orbost and Cann River districts, there being a growing tendency to get out of the present type, which through inbreeding, has become debilitated in constitution. Tamworths and Yorkshire boars are being used with the sows for first crosses with good results, and enquiry is now made for Poland China boars in other quarters for the same purpose.

Crops have been very heavy, the maize crop a record one, and new cribs have had to be erected on all sides in which to store it. The quality is also good. High prices rule for all classes of stock, especially stores, between which and fats there is but a small margin. Fodders in general use are maize, pumpkins, and mangels, and Chinese millet has been tried with great success in a few localities.

North-Eastern District.

Mr. Mathieson reports :—There seems to be every prospect of a good season, both in regard to grass and crops. The general condition of the stock is good. The rainfall has been fairly good throughout my district, the fall for the half-year, though not equal to the same period of last year, has been sufficient for ploughing purposes, and filled most of the dams and tanks.

Taking Wangaratta as the centre, the rainfall, so far, for this year has been :—January, 1·81 in. ; February, ·78 in. ; March, ·34 in. ; April, 1·23 in ; May, 2·32 in. ; and June, 2·75 in. ; total, 9·23 in. Last year the fall for the same period was 11·39 in., which leaves a decrease for the six months already passed of 2·16 in. The total rainfall for 1903 was 24·44 in.

Ploughing is about completed, and the acreage under crop in the North-East will, I learn, be equal to that of last year.

Harvest returns were fair, but a great quantity of hay was damaged in the field, causing a quantity of bad chaff to be on the market. Crops grown are wheat, oats and maize. Fully one-third

of the wheat was bleached in the field, rendering it inferior for milling purposes, but the rest was of good quality. Sowing is for the most part performed by the seed drill, and superphosphate, bone dust, and other artificial manures are in general use, at the same time due care is exercised in selecting the manures adapted to supply the special wants of the soil.

In some parts of my district the caterpillars played sad havoc with the crops, fortunately, however, their ravages were confined to small areas, or narrow strips of country.

Store stock are in good condition, and in the early part of the year there was a keen demand for this class of cattle, as also for breeding ewes, but latterly prices have a downward tendency despite the recent splendid rains. When the demand for store cattle was at its highest, the margin between them and fats was very small, graziers often purchasing so-called fats instead of stores. Fat sheep still command high prices, and there is a great difference in comparative prices between them and fat cattle, judged by other years. This, perhaps, is due to so many sheep being required by New South Wales graziers for restocking their holdings. Breeding ewes readily command from £1 per head upwards.

Lambing returns, despite the cold weather, will, where the ewes are properly cared for, exceed 80 per cent.

Stock are exceptionally free from disease, pleuro-pneumonia being almost unknown in the major portion of this district, while tuberculosis and actinomycosis are evidently on the decrease.

During the past half-year I have inspected 47,631 head of cattle, including 4,778 dairy cows. From the gross total I have condemned 18 head, the greater portion of which were tuberculous.

Of sheep 29,500 have been inspected, and in them I have found but few cases of fluke, although some parts of this district are usually very subject to it.

All pigs inspected were found free from disease.

South Gippsland District.

Mr. Curlewis reports:—Duties performed—Inspection of stock generally, attendance at markets, enquiries *re* disease, and relative to number of remounts available. Dairy cattle inspected, 2,582; killed, 14; isolated, 7. Other than dairy cattle, 29,365 inspected; diseases found—pleuro-pneumonia, tuberculosis, and actinomycosis; 23 destroyed, 93 isolated and quarantined. Pigs inspected, 5,056; diseases found, swine fever and pneumonia; 10 killed, 47 isolated. Horses inspected, 200; diseases found, strangles in a bad form and a few cases of stringhalt.

No disease observed in poultry.

Diseases prevalent—tuberculosis, pleuro-pneumonia, actinomycosis, swine fever, strangles.

Animal pests—rabbits, foxes, deer; insect pests—grubs; vegetable, *i.e.*, noxious weeds or growths, include take-all in wheat, bracken fern, star and other thistles.

Impaction and milk fever, as also cripples in cattle, are being more successfully treated by owners than formerly, hence there is a decrease in the mortality from same, whilst but few cases of string-halt in horses have come under my notice.

There are comparatively few sheep in my district, and I have not heard of any sickness in them.

Pleuro-pneumonia has appeared in three localities in my district, all directly traceable to one source, viz., cattle purchased from a city dealer about March 18th. In each case I declined to take virus from animals showing disease in an advanced stage, as no good result could ensue, and blood poisoning would follow. I am happy to state this disease has not spread to adjacent farms after quarantine restrictions were enforced. In only one case were milkers affected, and on this farm I forbade the milk leaving the place, and instructed that it should only be used there after boiling. The breeds of cattle most favoured in my district are the Shorthorn and Ayrshire, or a cross between these two breeds.

The milk yield average for the past six months, grass fed, one gallon per diem.; hand fed, 1½ gallons per diem. No cases of diseased udders found in cows.

Although dairies are not in an insanitary condition, there is room for much improvement in many respects. No cases of anthrax have come under my notice during the past six months.

Although stock are generally in good condition, the recent severe weather affected them detrimentally. Rugging milch cows during the winter months must tend to their advantage. General condition of country good, grass plentiful during the summer and autumn months. There was a slight scarcity of water in some parts during the autumn; plentiful now, however. Crops—early sown looking well. During a spell of dry weather in autumn many farmers were unable to break up the land or sow as early as they would have liked. Artificial grasses considered best are clover, rye, and cocksfoot.

Too early to forecast lambing average.

Very little dipping practised in my district.

Border Inspectors' Reports.

Senior Constable Stutchberry, Inspector of Stock, Delegate, reports:—Crops and grass good, fodder plentiful, stock in good condition and healthy.

Constable Considine, Inspector of Stock, Jingellic, reports a similar state of affairs, old residents in that locality averring this past season to have been a record one.

Inspector McLennan, Echuca, reports that self-sown second crops harvested in his district for hay and grain gave in some instances better returns than the first crop; autumn dry, however. Inspected 2,582 cattle locally raised, two destroyed for tuberculosis; attributes splendid health of cattle to the fact that no Queensland bred cattle have been through for some years. Lambing per cent. promises to be high.

Senior Constable Carter, Mildura, reports the stations in that district have not yet recovered from the effects of the drought; some stations are closed, others very much understocked; on these the stock were kept alive during the late drought by saltbush, of which three varieties are common, viz., creeping, dwarf and old man. At the present time there are thousands of square miles of mallee heavily grassed with spear grass, with not a beast running on it. Class of land in this district, mallee, with pine clad sandy ridges and box on the flooded lands adjacent to the river. All stock healthy, no grave disease in stock known in the locality.

Inspector Rockett, Narung:—Feed plentiful, country understocked, owners of fat wethers prefer holding them until after shearing. Dry autumn succeeded by nice showers. Stock healthy.

Inspector Irwin, Cobram and Tocumwal:—Dry autumn raised fears that dams and tanks would give out, but recent rains have replenished water storage, and induced a growth of young grass. Late droughts have killed off weakly animals, leaving only strong and healthy as survivors. Breeders change bulls frequently; cripples unknown. Ploughing delayed very late.

Inspector Forbes, Yarrawonga:—Season backward; recent rains give prospect of good season. Wheat general crop grown. Stock healthy.

Constable J. Green, Koondrook:—Stock all healthy; general type good. In cattle, breeds favoured are crosses between Ayrshire and Shorthorn or Ayrshire and Jersey. Average milk yield, $2\frac{1}{2}$ to $2\frac{3}{4}$ gallons per cow daily. Milk treated on farms by hand separators and cream sent to Cohuna or Gannawarra factories. Pleuro-pneumonia unknown for many years; anthrax unknown. Types of dairy construction, excavation with double roof, outer of earth or built up of sun-dried bricks, having double walls, intervening space of 1 foot being insulated with sawdust; double roofed, inner of shingles, outer of earth. Lambing over 90 per cent., in two cases 104 per cent. Horse breeding on increase; good type of draughts bred, but light horses other than ponies are decidedly inferior. Ponies have a strong dash of Arab and are a good class of animal. Have noticed a few mild cases of stringhalt. Poultry tick.—Whilst collecting agricultural statistics made inquiries among owners of over 2,000 fowls; this, together with the result of six months' inspection of poultry at railway station, strengthens the conviction there are none in this district. Irrigation.—Three trusts supply water to 200,000 acres in addition to private plants, and six feet of a rise in the Murray above

summer level permits of irrigation by gravitation. Fodders grown.—Sorghum and lucerne, the latter especially.

Inspector Kyle, Gooramadda:—Good rains in March and April have given a splendid season, prolonging the dairying operations to a later period than in ordinary years. All stock healthy and in good condition. As mild weather is prevailing, the lambing percentage should be high, the ewes being strong, and young grass plentiful.

Inspector J. Temple, Wodonga reports:—Grass abundant, nearly all stock being fat; owing to high prices for stores owners prefer not stocking, many holdings understocked. Stock all healthy; although season is a mild one, the practice of rugging horses and cattle is quite common. Several cases of supposed anthrax reported, but which on investigation proved not to be anthrax. Crops rather backward, but healthy. Little summer fodder grown. Quite a lot of hay lost through carelessness of owners not building their stacks properly, the so-called stacks being merely heaps into which good produce has been brought to rot or discolour. Many grass paddocks leased to New South Wales graziers. Quite a plague of mice this year.

Inspector Porter, Tintaldra, reports:—Season remarkably good: all stock in first rate condition, and winter feed abundant. Ploughing finished. The local mill has gristed 7,000 bushels of wheat for 1,400 bags of flour for farmers, and has declared a working profit. The cheese factory at Walwa has been worked with satisfactory results. The butter factory is handicapped by distance from market and upkeep of four creameries among a small number of suppliers, as the plant is capable of doing ten times the amount of work it is at present doing, with but slightly increased outlay. A reaction in favour of the milking type of shorthorns, as against the lighter dairying breeds, is fast setting in, as graziers will not touch steers of this latter type. As a result of Dr. Cherry's visit to this district, ensilage as a winter fodder is receiving attention from farmers; suitable crops are sown for this purpose, and rude silos are in use of various types throughout the district. Only one case of pleuro-pneumonia reported, but in New South Wales, a short distance from my crossing, there were over 80 cases in a hospital paddock, with bad tails through using bad virus. Bots have caused a lot of trouble on one estate in New South Wales adjacent to my crossing; 11 blood mares succumbed. Rabbits are numerous; a canning factory is in course of erection. This will, it is hoped, bring some more adequate return for moneys expended in dealing with this pest than has heretofore been the case. Anthrax unknown. Poultry tick unknown.

Inspector F. R. Temple, Wahgunyah:—Grass rather scarce owing to dry autumn; splendid rains have now fallen, and grass should be plentiful. Crops backward. Stock healthy. Lambing percentage should be high.

Inspector Wiltshire, Swan Hill, reports:—Dry autumn, season generally good, however, nice rains having fallen and prospects of

feed and lambing percentage high. Maggot-fly has caused a lot of trouble to some flockowners this season.

Inspector Wood, Serviceton, reports :—Grass plentiful, but heavy rains required for water storage. Old cultivation lands overgrown with noxious weeds. Ploughing delayed until late. Seed drills and artificial manures in general use. Very few cattle kept; these, save for a few cases of grass lumps, are healthy. A good type of merino sheep is kept throughout this district. Lambing average 98 per cent. Foxes reported to be destroying lambs on lands adjacent to the scrub. Dipping general. Dips in use :—Quibell's, Little's, Cooper's, and the home made arsenical dips.

Constable Anlezarck, Apsley, reports :—Grass fair, stock healthy. Owners assert that so much rain having fallen during the summer, the grass is not as nutritious as in other years.

Constable Moore, Dartmoor, reports :—Stock in good condition and healthy. The cold wet weather has caused owners to dry their milkers off early. Isolated cases of rickets reported. Sheep principally kept, holdings being understocked. Merinos, crossbreds, and comeback types generally kept, these thrive well in this district. Class of country, principally limestone ridges, grassy flats, large heath, and on the red land, bracken fern. This latter is burnt off in the summer, and sheep are very fond of the succeeding young growth of herbage. Breeds of cattle most favored are Shorthorn and Hereford, and a cross of these breeds with Aryshire. Poultry tick unknown. No cases of pleuro-pneumonia have occurred. Anthrax unknown. Little fodder grown for stock. Oats principal crop, although where tried potatoes yield good results. Too early to form estimate of lambing percentage. Dipping general, Cooper and Quibell's most in demand.

Constable Carter, Penola, reports :—Season good. Water abundant. Hereford cattle have given place to Alderneys. No wheat grown. Algerian oats, cut for hay yield to 2½ tons per acre. Other crops, mangels and potatoes. Sheep generally kept. Weaners this season much affected by worms. Dipping general, Little's dip most favored. Rabbits plentiful.

Inspector A. C. McEachern, Strathdownie, reports :—Stock in good health and condition. Dairying not followed. Breeds of cattle most favored, Hereford or Shorthorn. Comeback sheep mostly kept. Lambing percentage will not be high. No artificial grasses grown, the soil being considered too poor. Dipping general, Cooper's powder dip being the favorite.

Inspector J. McEachern, Nelson, reports :—Season good, with prospects of good clip and heavy percentage of lambs, the weather being mild, the ewes strong, and grass plentiful. No cropping, unless Algerian oats for hay for working horses, yield up to 1½ tons per acre.

STOCK EXPORTED FROM VICTORIA DURING THE HALF-YEAR ENDING JUNE 30TH, 1904.

Horses	3,785
Cattle	23,790
Sheep	271,725
Pigs	296

STOCK INTRODUCED INTO VICTORIA DURING THE HALF-YEAR ENDING JUNE 30TH, 1904.

Horses	3,780
Cattle	26,829
Sheep	253,312
Pigs	390

REPORT OF THE VITICULTURAL EXPERT.

M. d'A. Burney.

I have the honour to report as follows upon the vintage at the Viticultural Station and upon the present state of the wine trade :—

The cellar arrangements here were, by no means, all that could be desired, and there was much to be done before vintage in improving the plant and preparing casks to receive new wine. Picking was carried out under favourable weather conditions which generally benefited the quality of the wine throughout the State. The wines made here are of the following types :—

From the Shiraz Grape	A full round export wine.
,, Cabernet ,, ...	A dry full wine of considerable style and character.
,, Mataro ,, ...	A tawny port of ordinary quality but exceptional colour, made so as to produce a marketable article from an inferior grape.
,, Muscat ,, ...	A sweet wine, clean and smooth.
,, Aramon & Cariquam Grape	A thin characterless wine.
,, Pedro .. .. ,,	A sweet wine full of character.
,, Riesling .. .. ,,	A heavy dry wine with slight sherry flavour.
,, Gouais .. .. ,,	A dry wine of no particular character,
,, White Hermitage .. ,,	A light delicate table wine of some promise.
,, Anearat and Ivanhoe ,,	A wine approaching a Sauterne, purposely not allowed to ferment out dry so as to watch the effects of subsequent pasteurisation.

The whole vintage was fermented with an imported Algerian yeast, and although the result was most satisfactory, next vintage I wish to experiment with other yeasts, as in this connection there is a wide field for improving the quality of the wines by the use of yeasts suited to the local conditions of soil and climate. The red wines were fermented in the ordinary way, with submerged false heads, except the Mataro, which was fermented without the skins so as to obtain the desired pale colour.

The white musts were all pumped from the press into open vats, and before fermentation had commenced, were skimmed and pumped off their lees into casks, when tannin was added and fermentation allowed to proceed. The wine made after the Sauterne type had the fermentation checked by sulphuring, and in the case of the Pedro, by the addition of spirit. At four months old the white wines are quite bright, and the red wines almost so without filtering or fining. A filter is badly needed in a properly equipped cellar, particularly where pasteurisation is intended, and the want of one has prevented me from carrying on this year experiments with unfortified sweet wines of low alcoholic strength. I am about to pasteurise all the unfortified wines in the cellar, noting what results may be obtained if they are then allowed to mature unracked. It would be of value to know what saving, in handling, can be obtained by this method. I have sent 1 hhd. of dry red wine and 1 hhd. of dry white wine for

storage in the Government Cool Stores. By the courtesy of Mr. J. Knight, the wines are being kept at a constant temperature of 35 degrees Fahr. The effect of the prolonged influence of cold will be subsequently investigated.

I have at the request of growers visited numerous cellars and have tasted samples representing about 1½ million gallons of wine. Cellars are generally well stocked, and the quality of the 1904 vintage is generally much above the average. Trade is at present dull, and sales are difficult, and the outlook is not a very promising one in view of the probability of another large vintage. In many cellars there is a lack of methodical management, and even ordinary care and cleanliness, which annually cause a loss of wine out of all proportion to the quantity produced. This, together with a want of uniformity of sample, is a great deterrent to trade, especially owing to the difficulty buyers experience in obtaining repeat orders up to sample from the producers. As the production at present exceeds both local requirements and the export market, the opening up of further outlets is badly needed. The excise duty of 1s. per proof gallon on wine spirit used in fortifying, effectively prevents the export of sweet wines. With cheaper spirit our sweet wines could well compete in the London market both in quality and price with the same class of wines from Spain and Portugal. It would be of benefit if a drawback could be obtained on sweet wines exported, equivalent to the duty paid on the spirits added.

The brandy trade is not the back bone to the industry that it ought to be, mainly through grain and potato spirits, which cost far less to produce, being allowed to be labelled and sold as brandy. It is an anomaly that only a pure wine spirit bearing a heavy duty, viz., 25 per cent. *ad valorem* can be used for fortifying wine, and thereby preventing a remunerative export trade, while a brandy goes into direct consumption as such, although in reality it is often a grain spirit sweetened and flavoured. Latterly the bulk of the spirit used for this purpose imported into Victoria is from the refuse of the sugar cane, and is distilled in New South Wales and Queensland, and obtained at such a low price that Victorian grain and potato distillers have had to shut down.

The majority of the vineyard stills answer their requirements fairly well, though recently I had occasion to alter one that was of somewhat defective construction, and it now exhausts 500 gallons of wine in eight hours, instead of fourteen hours, and a strength of 65 O.P. is obtainable instead of 58 O.P. In the larger wine distilleries the stills are much behind the times, but at the present moment, owing to the abovementioned competition, there is little inducement for systematic brandy production.

REPORT OF THE VITICULTURAL INSPECTOR.

G. H. Adcock, F.L.S.

RUTHERGLEN.

Since the issue of our last report we have lost the services of Mr. P. Wyatt, who has gone to an important Government position in South Africa.

The work of distributing the American resistant vines has been continued, but under somewhat different conditions to those formerly existing. As forecasted in last year's report, a charge is now made for both cuttings and rootlings. In 1903 we sold and despatched 92,000 of these resistant stocks, of which about one half were sent to Cape Colony and New Zealand.

The mother stocks, under the more favorable climatic conditions, made almost phenomenal growth, and the future supply of wood for cuttings or grafts is amply assured for all likely demands, not only in this but other States.

Grafting operations were carried on as usual, and with increased success. The favorable season materially assisted in giving us a high percentage of "strike." The shed at present utilised for the bench grafting is very unsuitable, and early this year I submitted plans of a building that would not only prove convenient, but would be economical by reducing time and handling. It is to be hoped this necessary provision for carrying out a very important work will be undertaken in the early future. The subsequent care of the grafted scions is even more important and more difficult than the actual grafting. The grafted cuttings must be carefully tended. They must not be allowed to become too moist or too dry, and the temperature must be kept as even as possible. They are therefore packed in sand, and protected during cold nights and wet weather under glass frames. Over 35,000 grafted rootlings were submitted for sale this year.

The phylloxera is steadily spreading, and a further area has been uprooted and is to be replanted this season. The reconstituted portion of the College vineyard, situated as it is alongside the main road, naturally attracts a good deal of attention from growers. It affords the best advertisement the resistant stocks could possibly have, as it is surrounded with phylloxerated European vines. The growth of the grafted vines (Schiraz on American stocks) has elicited unstinted praise from visitors, and especially from several practical inter-state viticulturists. They have also succeeded beyond my most sanguine expectations.

This method of reconstitution, by spreading the cost over several seasons is recommended to the vigneron who is unfortunate enough to have his vines phylloxerated. As the European vines become

unprofitable they are replaced by the best varieties grafted on resistant stocks, and thus before the whole of the original vineyard has succumbed, or been thrown out of bearing, the earlier reconstituted portion is beginning to be profitable. This avoids a large outlay at one time, and is the plan adopted at the College vineyard.

The importance of continuing our experimental work is still as urgent as ever. We may fairly claim in Victoria to have done a good deal in demonstrating the adaptabibity of the various resistant stocks to the diverse soils and climates of our viticultural areas, as well as testing the grafting affinities of these stocks to our principal varieties of wine and table grapes. In this respect it may be noted that, at my request, the Government placed itself in communication with the British consul in Greece to ascertain what was regarded there—the home of the currant industry—as the most suitable resistant stock for the Zante currant. The reply may perhaps be taken as a tribute to the value of our own experimental work, seeing that, though we have found by actual experiment, stocks which possess good grafting affinity for this particular variety, yet in Greece they are only now commencing their experiments by growing seedlings.

Still very much remains to be done, and experiments should be systematically carried out in every viticultural district to equip us for the important work of reconstituting.

It would be an excellent plan to have a small area reconstituted by the Department in every phylloxerated district. The grower might reasonably be expected to provide the labor, and the value of reconstitution would be practically demonstrated under the observation of those whose life work is being destroyed by the invasion of phylloxera.

Experimental plots of wheat were sown by the working staff. Some plots were manured and some were not. The results which furnished the subject of a special report, afforded a strikingly practical object lesson as to the value of fertilisers.

District Experiment Stations.

The nurseries at Bendigo, Great Western and Ararat have been handed over to Mr. H. Keck, Hon. Hans Irvine, and Mr. L. Mooney respectively. The Hon. Hans Irvine, of Great Western, has earned the renewed thanks of this branch and the viticultural community in general for the generous assistance he has rendered in the past and for his promises to continue the same. At Mooroopna the directors of the Goulburn Valley Winery have undertaken to look after the plot and distribute the cuttings and rootlings. It has therefore been transferred to them, with Mr. H. Fortin as supervisor. The vines sent to Mildura have succeeded well. They have, in fact, made extraordinary growth. There will, henceforth, be a large number of cuttings available from this centre, which, like the one at Longerenong, is remote from any known infection. At Mildura a permanent experimental station is being established on the block originally selected as the site of the Agricultural College. The fencing, chan-

nelling and cultivation have already been done, and the planting is to be undertaken immediately.

During the year the area under American vines at Longerenong has been increased to five acres. These vines are to be trellised for the growth of cuttings.

At Leongatha the collection of stocks imported from California has done well. These varieties will be multiplied as rapidly as possible, and sent out when a stock is obtained.

Importation of Desirable Varieties.

Early in the year an order was placed in France for cuttings of approved and more productive varieties of wine grapes. These were selected on the recommendation of Mr. M. d'A. Burney, formerly of Château Tahbilk Vineyard, but now Government Œnologist. It is confidently expected that when these varieties have been propagated and extensively planted they will leave their impress on Victorian viticulture by improving both quality and quantity.

Inspection of Vineyards.

Owing to the reduction of our staff of inspectors we have no systematic inspection of vineyards at present as formerly, consequently we have no reliable records of the extension of phylloxera or the presence of other diseases, since our staff was disbanded owing to retrenchment. I have personally visited a large number of vineyards in various districts.

Correspondence and Reports.

The correspondence during the year has been heavy, and in addition the following special reports have been published:—

Experimental Station work; Descriptions of American Vines received from California; Valuation of Viticultural Station, Rutherglen; Educational value of Experimental Viticultural work; Adaptability of parts of Stawell district to Viticulture; Breach of Viticultural Regulations; Importation of Choice Productive Varieties of Wine-grapes; Technical Agricultural Education in South Australia; Viticulture in South Australia; The Lysol Treatment of Phylloxera; Reports on Botany Examinations, &c., &c.

Papers have also been furnished to the *Victorian Year Book* and the *Journal of Agriculture.*

Fungus Diseases.

With a return to seasons of more generous rainfall these appear to be somewhat on the increase. Those vignerons who carried out the suggestion in my last report, viz., to swab or spray the vine during the dormant season with some fungicide, have found the benefit of such treatment in their immunity from such diseases.

Inter-State Visit.

During vintage a visit was paid to some of the leading South Australian vineyards and cellars. The opportunity was also taken to

enquire into the system of technical education adopted in the sister State—more particularly as it relates to agriculture. Both these investigations formed the subject of comprehensive reports. The most interesting feature that presented itself to me in educational matters was the facility offered by the Adelaide University to candidates for the B.Sc. degree to qualify in such subjects as agriculture, viticulture and œnology. This is in my opinion a very commendable and forward movement. I cannot speak too highly of the courtesies extended to me, as well as the facilities offered by every officer in the Agricultural and Educational Departments, and the School of Mines.

Educational Work.

A considerable amount of time has again this year been cheerfully devoted to lecturing in connection with the agricultural classes in various centres. It is gratifying to observe that these classes are increasingly popular. The subjects taken are viticulture and agricultural botany, and over 50 lectures have been delivered since last report. Numerous demonstrations have also been given in bench grafting.

Manuring Experiments.

As the grafting of vines tends to promote productiveness, it will be necessary to supply, in the form of fertilisers, the substances removed by the crop. I would suggest therefore that experiments be conducted with manures.

In conclusion, I may perhaps be permitted to repeat myself with regard to the importance of experimental work. From our experimental plots, and also by the courtesy of the vignerons who have planted resistant stock, we are carefully recording data. Each year is adding to our knowledge and experience, and on the accuracy of our information the future of Viticulture in Victoria depends. To gather reliable data has been, and will continue to be, the chief object of this branch.

REPORT OF THE PRINCIPAL OF THE SCHOOL OF HORTICULTURE.

C. Bogue Luffmann.

Introductory.

The success of the students of the School of Horticulture, and that of the fruitgrower of the near-future, is largely dependent on the quality and plan of the Burnley Estate. Throughout Victoria, considerable areas once regarded as perfect fruit-growing land, have become practically exhausted through the irregular system of taking all and returning nothing to the soil. It follows that a more precise system of soil conservation must be established if we are to obtain permanent and profitable occupation of the existing orchards.

It is possible through the medium of the Burnley Estate, and an extension of the various methods adopted thereon to small reserves in country districts, to lay the foundation of a system of soil management and fruit production in strict accord with local conditions and demands. The failure to observe the true nature of raw material and influence of phenomena in the form of climate, has gone far to interfere with the success of numberless adventures in fruit production

Apart from an admirable site and sufficient area when gauged by acres, the Burnley Estate holds, as a natural quantity, nothing favorable to the making of either orchards or orchardists.

A poor class of river clay, patches of river-washed sand, over a sour bottom of basaltic boulder country, with no means of either under-draining or deep cultivating, offer nothing of an inviting character on which to start to teach a country's people how they may win an existence from a few acres of more or less arid and unirrigated land.

The recognised work of the year has therefore been the making of an estate which will, as far as possible, serve the needs of the fruitgrower and settler on a few acres. By persistently acquiring all available soil and litter from outside sources, by trenching and sub-soiling wherever practicable, and by draining and manuring as far as means would permit, the larger proportion of the estate of forty acres has been entirely transformed. The gain is incalculable; since a permanent foundation has been laid and a means to instruct, which can never fail of its object.

School Work of the Year.

This has been on the whole very satisfactory, since the work provided has proved interesting and congenial. The general

behaviour of the students has been good, and not a single fine or other punishment was imposed.

In the class work some excellent papers were written, and the quarterly and general examinations showed the highest average of marks yet obtained for the school.

A gold prize offered by Messrs. Langwill & Davies for an essay on Spraying was won by Student T. G. Baldwin, who contributed an excellent addition to the literature on this subject.

Several students completed a two years and one a three years course, and left the school. The new students enrolled during the year numbered about twenty-five. The number at the end of the year 1903-4 is thirty, made up of seventeen male and thirteen women students.

The fee of £5 per annum which has been exacted in the past year has not affected attendances, whilst it has had a steadying effect on the character of the student and their parents.

The fee is excessive when it is considered that the agricultural colleges give free education, but with every means for the complete training and equipment of the student attending the institution, there need be no diminishing of the fee.

Training of Gardeners.

The value of the gardening industry in all forms is very considerable, yet no training ground is provided in the whole of Australasia, except at this institution. It would therefore be well to offer a free education to two or three youths through the medium of State School scholarships, in order that the demands of local gardening may be met and a far larger outlay made in the beautification of Australian homes.

At the same time capable but poor boys who desire to be fruit-growers should have some chance of getting instruction here. Either by examination after training at the Working Men's College or any night school or institution, they should be regarded as eligible for a one, two, or three years' course.

Students as Lay Helpers.

Wherever senior students have been found trustworthy they have been sent into the country to assist in the planning, planting and pruning of orchards. This has proved of value to both owners and students, as the one is helped over his difficulties and the other enabled to test his own judgment and ability apart from his school instructors.

Working Men's College Class.

The Agricultural Chemistry Class of this institution has commenced field operations on a piece of natural soil, and it is intended to test and demonstrate various manures, and methods of stimulating plant growth. The advantages will be twofold, as the Working

Men's College instructors will be able to support their teaching by actual demonstration in the field, and the Burnley students will have the advantages of such field practice.

Correspondence and Visitors.

Correspondence, in the nature of advice to orchardists and reports to various Governments and institutions, has called forth over 2,000 communications for the year. It is to be regretted that no system is adopted whereby replies to correspondents embodying original and generally useful material may be transmitted to the press for the benefit of the public.

Would not a frank stamp, costing the Department of Agriculture say one farthing, and affixed to all correspondence desired for publication, enable the receiver to forward to the newspaper editor of his district? The subject has been urged before, and allowing for the amount of time and thought given to, and the possible value of such correspondence, it seems that a great deal could be done to educate the producer on his own ground, and at the same time prevent much endless repetition.

Visitors to the School of Horticulture average about three a day, or slightly under 1,000 a year. Most of these seek practical advice or instruction, and a great deal of time is therefore devoted to them.

Demonstration Orchards in the Country.

The six small demonstration grounds which were formed in the winter of 1902 have proved a fertile source of instruction to orchardists, gardeners, and small farmers.

The entire area of each plot is devoted to fruiting trees most favourable to soil, climate, and market requirements; but advantage has been taken of spaces between the rows, and fodder, vegetable and green manure crops grown as a means of nourishing and extracting a profit from the soil till the trees come into bearing.

Some striking results have been obtained by boldly ridging before planting flat and poor land. The trees resulting from this treatment are in most instances equal in size and character to sturdy four year old trees, though in reality but two years planted. It is undeniable that by ploughing three or four times in one direction so as to produce bold ridges of loose and aerated soil, and planting as high as possible, that a much larger body of well prepared earth is made available to the roots at all seasons. The winter soil does not become saturated, cold and stagnant, nor does the summer sun exert the same influence in dissipating moisture.

It is intended to further increase the height of the planting sites in all flat, badly drained, and wind-swept country; and by way of further instructing the orchardist a series of diagrams with descriptive letter press will be issued in due course. The hard pruning of young trees, reduction of their root systems, bandaging of trunks and heavy mulching of the surface, have all proved of great value to

the trees and to those receiving instruction. Whilst everything has been done conceivable with the best interests of the trees and the imparting of safe object lessons, there has been no lavish or exceptional expenditure in any direction. Ploughing and cultivating have been carried out to keep the soil sweet, clean and acceptable to the trees at all seasons. The occasional collecting of surplus soil from headlands and placing at the disposal of the trees, has cost but the merest trifle, whilst adding materially to the length of life and general value of the orchard.

The partial failure of the Horsham block of trees, due to the failure of the Wartook water supply (this block being laid out to grow trees under regular irrigation) has now been corrected; and some remarkable samples of trees are to be seen, where the land has been deeply channelled, and the trees planted at much higher levels than is customary in the irrigated orchards of Victoria.

At seasonable intervals lectures and practical lessons have been given in the locality of each demonstration orchard. The average attendance has been good, and the standing results of our labours leave no doubt as to the value of the lessons which will be learned.

Although the main object of these demonstration orchards is to show how land should be laid out, drained, manured, surface-formed, and trees planted and pruned till they come to bearing size, it is at the same time possible to deal with the general principles and practice of fruit growing. Hence a great deal has been done in adjacent orchards where trees and soil have been defective, and advice needed.

Finally, these orchards will prove a success because the actual work has been done by State servants. So strong is the belief that all State teachers are mere theorists, that no one of them can help the man on the land till he can give proof of his ability to prune and plough with his own hands.

Field Lectures and Practical Lessons.

During the year upwards of 50 lectures and field lessons have been given to rural producers. The subjects chosen were in all cases in accord with local requirements. After several years of persistent work in the chief fruitgrowing centres there are signs of radical changes in the way of managing soil and trees. It is no use hiding the fact that a great many engaged in fruitgrowing have not sufficient instinctive capacity to enable them to get inside a tree, or underground, and discern the subtle processes which act for and against the growth of plants. For these we can do little, at best but patient and earnest imitators, they fail whenever they are left to themselves for more than a brief season. But a sufficient number of clear-headed and industrious orchardists are now at work to secure a more exact system of production. Working methods, standards of quality, and marketing, have yet to be arranged for each locality and class of production, and it is to these that our teaching has been directed.

The audiences addressed in country districts total for the year 2,600.

Position of the Producer.

The fruit industry has been unpopular—more so than any other branch of farming—for a considerable number of years. This does not arise from any inherent defect in the fruit, the country, or the markets, but rather from an irregular and one-sided system of production; and in order to have the industry permanent, profitable, and open to a considerable number, it must not be regarded as independent of other vegetable and animal productions. Making due allowance for the existence of orchards in all parts of the State, and for the fact that a very small proportion of our territory is naturally and permanently rich enough to maintain profitable trees, it follows that in all open and comparatively poor regions orcharding if carried on, should always be associated with pig or dairy farming or both, in order to secure an abundant supply of bulk manure. Most fruit trees fail through needing a deeper and richer soil. Chemical manures cannot add to the depth, drainage or condition of the soil. They do not affect temperature or tend to increase or retain moisture, hence they may not be relied on to give permanence to soils or the fruit industry in a warm climate. Even where irrigation is practised chemical manures are not all sufficient, and though one takes a risk in making these assertions, they must be made and insisted upon, as they can easily be proved if we are to start fair, and continue in a fair way.

With rare exceptions we have no occasion to withdraw absolutely from any tree-planted areas, but we should, and that quickly, add animal to that of fruit production.

A properly fed and bedded pig makes five tons of manure a year. Every acre of trees in the country needs on an average five tons of bulk manure each year. The gain in fruit and bacon makes the land and its owner richer from year to year. The markets are glutted with inferior fruit which tends to bring down the price of the good. With better soil, better fruit with finer keeping and selling qualities will result. With animals as a means of disposing of all inferior fruit, the growing of fodder crops, and the produce and refuse from a cow or two, there is more than enough for the orchardist and the orchard. It must be repeated that as State teachers we must insist on animals being made a substantial factor in fruit production, wherever chemical manures are incapable of furnishing sufficient vitality to the soil.

REPORT OF THE BACTERIOLOGIST AND SCIENTIFIC INSTRUCTOR IN DAIRYING.

T. Cherry, M.D., M.S.

During the past season steady progress has been made by the dairy industry in Gippsland and the Western Districts, and the North and North-East have begun to recover from the effects of the drought. In the North-West the only factories that remain open are Warracknabeal and Stawell. All through the wheat-growing area the good harvest of last season has gone far to help the farmer to make good the losses incurred during the previous dry seasons, but on all sides there are indications that the prospective low prices for hay and grain have already brought into prominence the question of the live stock of the farmer. The re-launching of the dairy industry, all over Victoria, is only a question of a year or two. In the first place it is recognised that there is no method of ordinary farming by which the same amount can be secured from any given area of land as through the medium of the cow and the pig, and in the second place, the adoption of the modern silo, while valuable to every farmer, will enable the North to prepare for dry seasons and allow of green feed being kept in stock from year to year. The surplus of good seasons may thus be utilised to meet the demands of the drought.

Taking the districts in order, we find that the Upper Murray, Springhurst, Wangaratta, Benalla, Yea and Euroa have more than held their own, and there are good prospects of a substantial extension in this area. This district was comparatively little affected by the drought. Large areas were leased to starving stock, but with the return to normal seasons dairying has steadily increased. The rich valleys of the Mitta, Kiewa, Ovens and King, and the lands bordering the numerous creeks that are found in all parts, are admirably adapted for dairying. The growth of both summer and winter fodder crops promises to become a marked feature of this district.

The Lower Goulburn Valley has largely gone out of dairying for two opposite reasons. The drought was severely felt all over the area, and in consequence the irrigated land in the Rodney Trust became very valuable for grazing purposes. The dairy cow was thus displaced from both areas. This district usually yields the heaviest crops of wheat and oats, the land is in comparatively large farms, and with ordinary seasons the harvest returns, combined with grazing, are sufficient to make the farmer very loth to undertake the steady work of dairying. The best chance I can see of reinstating the industry is by closer settlement on the irrigation areas.

Matters are progressing in the Loddon Valley. The Bendigo milk supply keeps the cow in evidence, and the smaller amount of water

available for irrigation constrains the farmer to irrigate smaller areas, and consequently more intense culture is apparent. Summer fodder crops are largely grown. Near Gunbower one of the most up-to-date systems of silage is found, the silos being filled in November with the first cut of the lucerne, the odds and ends about the paddocks and part of the wheat crops. Barley and rye are also grown as winter fodder crops. In April the silos are filled with the maize and amber cane grown under irrigation. The factories at Boort, Pyramid Hill and other places are getting well through the difficulties occasioned by the drought. The amount of amber cane grown round Boort was an indication of the capabilities of the north in an average year. Further west occasional farms are found round Dunolly, St. Arnaud and Stawell, and the present prospects of the Warracknabeal factory are good. Much of the supply comes from Beulah, Hopetoun and other parts of the Mallee. Here and there in the Horsham and Nhill districts a farmer has managed to continue dairying all through the drought, and I hope before long to see the silo permanently secure the position for the dairy cow all through the Mallee. The marvellous growth of mangels, rape, barley and rye through the winter months, even when the rainfall is below the average, bears testimony to the quality of the soil. The continuous sunshine elaborates a larger percentage of nutrients in the herbage and pastures, and at the present moment, when live stock in Gippsland and the Western District are below the average, the cattle in the Mallee are rolling fat.

Crossing to the southern slope of the divide, we find a very progressive and satisfactory condition in the Western District. Land values and rents are rapidly increasing, and the problem is how to milk more cows off the same area. Cultivation is therefore coming more to the front, and the silo is now to be found round Colac, Terang and Port Fairy. Root crops are fairly common, and last summer there was an unusually large amount of maize grown. Around Koroit most farmers grow oats, barley, roots, peas and potatoes, and a large part of this produce is fed to the cow and pig. I have made efforts to draw the attention of the hay growers in the Smeaton and Lancefield districts to the advantages of this method, but it will probably take another year or two of low prices to induce them to change their methods. In the dry districts near Melton more than one example is found of the extent to which water can be collected and stored on the average farm when the rainfall is over 20 inches. Large dams aggregating from 10 to 20 thousand cubic yards are gradually constructed, and it is found that one with 1,000 cubic yards of water is amply sufficient for an acre of summer crops. Similar large dams are used by the orchardists near Ringwood. These pioneer efforts, as well as the private irrigation schemes in the Bacchus Marsh Valley, are worthy of the most careful study. They show what can be done in nearly all parts of the State (except the northern plains) by individual effort, and if generally adopted would simply revolutionise farming throughout Victoria.

In Gippsland the most striking feature is the extent to which maize has been grown as a summer crop. Many dairy farmers are cultivating it, both for grain and silage, and it may be safely said that lucerne and maize form the two most valuable crops that the farmer can produce. In South and Central Gippsland dairying has made steady progress, and the number of cows is steadily increasing. Shelter during the winter nights is also receiving attention, while there can be no question as to the development of the pig-breeding industry. In East Gippsland the maize harvest was a record crop, but there are two problems that have to be solved. Low prices for grain and long distances from the market have made the results of the year's work unsatisfactory from the financial standpoint. The maize grower is in the same predicament as the hay grower. Fortunately every part of the maize plant can be utilised by the cow and pig as grain and silage, and I hope to see general farming come into vogue with dairying as the mainstay.

Efforts to bring about the general practice of feeding silage made by modern methods have been steadily continued during the past year. It is satisfactory to be able to report that there are indications that our farmers will soon follow the lead of the Americans, and before long a silo will be looked upon as the most important part of the equipment of the farm. Thirty overground silos have now been erected, and I expect to see a large number built during the ensuing season. It may be as well to state that the essential parts of the new method are first to chaff the green fodder, and then to pack it in a deep, circular, air-tight silo. In order to reduce the cost of the building we now make the frame of 4 x 2 sawn hardwood or straight saplings placed 18 inches apart round the circumference of the circular silo. These are held in position by hoops made of 4 x ½ in. hardwood. The thin hoops can easily be bent to the required curve and nailed to the studs. The method of lining now recommended is simply to nail sheet iron (22 gauge, black or galvanized) on the inside of the studs and give it a coat of tar or ruberoid paint. As the silo is filled, the inside receives a coat of limewash in addition. The materials for a 100-ton silo may be obtained in Melbourne for less than £15. In dry localities an additional 6 feet in the depth of the silo may be obtained by excavating a circular pit the same size as the overground part, so as to continue the walls perpendicularly the entire depth. In wet districts the underground part requires to be lined with brick or concrete.

The amount of maize grown for fodder has been much larger than any previous year, and in Gippsland much of this has been made into silage. Over 5,000 tons have come under my own observation, and from reports received from various districts I estimate the amount made in Victoria last season at well on to 20,000 tons. Most of this is still made in the stack, but it is satisfactory to find that the value of chaffing it while green is everywhere recognised, and efforts are being made to adopt this method next season. The difficulty of the elevator is being met by owners of travelling chaffcutting plants providing a long one with their machines.

The advantages of the silo are such that the facility with which the crop can be secured is just as important as the provision of green fodder for feeding in the dry season. At Colac two silos were built when the oat crops were nearly ruined by caterpillars. Alternate loads of oats, and trefoil and clover were carted to the chaffcutter, and the result has been one of the best samples of silage ever analysed. I append Dr. Howell's results, with average American analyses, for purposes of comparison.

—	Water.	Digestible Solids per 100.		
		Protein.	Carbohydrates.	Fat.
Maize, American	74	1·3	14	0·7
Lucerne ,, ...	72·5	3	8·5	1·9
Oats and clover, Colac	72·5	2·6	14	1·3

Where maize or amber cane is grown it is admitted that the silo is the only way to secure full feeding returns from the crop. With surplus stacks of hay and straw on every farm throughout the northern plains, it will be as well to make a few acres of next season's crop into silage, if only as an insurance against future droughts. But independently of this consideration, it must be recognised—first, that the low price of produce enhances the relative value of live stock, and secondly, that the stock-carrying capacity of every farm is limited by its condition during the *worst* months of the year. Could the state of the pastures which obtains in October be secured all the year round, the amount of live stock could at once be safely doubled. The modern silo places this within the reach of every farmer who will take the trouble to grow sufficient crops for the purpose, and utilise the surplus that is found in the northern pastures in the good years. American experiments show that good silage will keep practically unchanged for periods of eight or ten years, and probably for an indefinite time longer. It is safe from the influence of the weather and from attacks of birds and mice. It may be made equally well in wet or dry weather, and it is the only way in which the surplus growth and weeds of the farm can be utilised, while it conduces to keeping the land free of weeds and thistles, because seeds of all kinds have their vitality absolutely destroyed by the moist heat of the silo. Even after the grain is harvested, the straw or maize stalks may be utilised by being moistened as they pass into the silo, or by mixing them with green, juicy material, such as rape, thistles, or marshmallows. So long as the material passes through the chaff-cutter it is certain that silage can be made of almost anything that grows on the farm. The simple rule is to make the juiciness approximate to that in a crop of oats or wheat a few days before it is ready to cut for hay. The question for the future is not whether it is worth while making silage, but whether for home consumption it is worth while making hay.

With regard then to the coming season, I hold that in view of the heavy stocks of hay and oats everywhere seen, it will be wise for all farmers, whether dairying or not, to adopt the silo. It may be filled

partly with the surplus pasture, self-sown crops and rubbish, in November, and partly, if necessary, by part of the area which otherwise would go for grain or hay. This plan will secure the green fodder necessary to keep live stock of every kind in good condition during the dry months of summer; while in addition, in most districts, summer crops of maize or amber cane may be grown to fill the silo a second time for winter use. As a guide to the weight that may be expected from any area, it may be stated that a crop which would make two tons of hay to the acre will produce about seven tons of silage. No weights require to be placed on the chaff if it is trodden down tightly as the silo is filled, and the total depth is 16 feet or upwards.

During the year 119 lectures have been delivered, the attendance averaging 52. Three classes for factory managers have been held, with an average attendance of 9.

ADDENDUM.—From analyses made this year, the saving in food materials (chiefly sugar) obtained by chaffing the green fodder amounts to 10 per cent. of the total amount of dry matter present in the silage.

REPORT OF THE INSPECTOR OF FOODS FOR EXPORT.

A. A. Brown, M.B., Ch.B.

The year ending 30th June, 1904, was exceptionally moist, rain having fallen at fairly short intervals right throughout; and last summer, differing much from previous seasons, was comparatively cool. During the year there was, according to Mr. Baracchi, a general average fall of 30·37 inches of rain over Victoria, and it was fairly evenly distributed. In consequence of the humidity and geniality of the seasons, grass and water were everywhere abundant, markedly contrasting with the conditions prevailing for such a long period prior to April, 1903. The prolonged drought existing up till 1903 devastated the flocks and herds of Australia, and it is estimated that through it the number of sheep in Australia fell to about 60,000,000. Previous to the disastrous drought there were something like 100,000,000 sheep on the continent.

The percentage of lambing in Victoria will, if favourable conditions prevail this coming season, average fully 85 per cent., and in New South Wales about 80 per cent. If the percentage forecasted is actually realized, and if no great mortality from any cause whatsoever occurs to upset calculations, then there will be a large number of lambs available for export about September next. I have been informed that from four stations alone in the Riverina there will, no casualties eventuating, be something like 60,000 lambs despatched to the freezing works for export. Sellers must understand that the volume of an export trade depends wholly on stock being offered at payable rates to exporters; but if they intend keeping up the prices to the level of last season, then efforts at expansion of trade are frustrated. The prognostications for the season 1904-5 are that it will be marked by a large increase in shipments of lamb. If we are fortunate enough to have a continuous run of two good seasons like the present, then in another two years the number of sheep in Australia will be again augmented to 100,000,000.

As a matter of fact last year grass existed in such profusion that there did not exist sufficient stock to consume it.

In 1903 there were in Victoria, at a rough calculation, 1,600,000 cattle, 392,000 horses, 10,842,000 sheep, and 300,000 swine.

It is a pity that when grass is so plentiful stock-owners are not more anxious to conserve it. Stack ensilage could easily be made, and at a cost of between 4s. and 5s. per ton. In seasons of plenty, ensilage should be universally made, and graziers would find it advantageous to adopt the practice. Attention is here directed to the fact that in 1903 Victoria had 962,665 acres under sown grass, and New Zealand 12,000,000 acres.

It does seem astonishing that Victoria, with all its natural advantages and the great producing industries that it has at stake,

is so backward in making provision for fodder for stock. A few farmers do make ensilage, but they are the exception rather than the rule. In Victoria in 1903 only 10,931 tons were made. The conditions surrounding sheep husbandry are now quite altered to what they were 12 years ago. Then there was little or no export of frozen mutton from Australia, now it is a staple export commodity. Then sheep off the shears had no great market value, for there was no outlet for the ever-increasing number except through the medium of the boiling down works. Fifteen years ago it was no uncommon thing to see sides of mutton sold for 1s. 6d. and legs of mutton for 6d. in the markets and shops of Melbourne. Nowadays such a state of things is impossible, unless some protracted interruption occurred to our export trade. The export mutton trade has been of incalculable advantage to graziers, as now instead of, as at one time, trying to force their surplus stock on the butchers and boiling down works, they can hold on to it and await the solicitations of the representative of the exporter, who is an eager buyer.

In consequence of the prices ruling so high last season, export operations stopped about January last. In the earlier part of the season Messrs. Lowe and Peppard assisted in the inspection of foods prepared for export in the metropolitan area, and later, through Mr. Peppard being transferred to the Agent-General's office, London, Mr. Holt, whose work at Hamilton has been completed, took up the running. At Geelong Mr. Pollock, who was appointed for the season to supervise exports of meat from that port, very ably conducted inspections. The War Office authorities now require a tag certifying to inspection to be attached to each carcase, and this requirement entails considerable labour and the bestowal of close inspections. The high price prevailing last year for stock was the cause of the export trade being very much contracted. Further, graziers were loth to part with their stock to exporters at a price that would enable export operations to be conducted, and, through so many holding on tightly, the local markets even were undersupplied, and the price of mutton in Victoria went up to 4d. per lb. wholesale. Not only did those graziers who parted with stock get exceptional prices, but they were confident that they were running no risk if they held on, as the prospects of the seasons keeping favourable were never more certain. In good years ewes of six years of age are generally parted with, but last year ewes of all ages were kept for breeding purposes, and scarcity of mutton in the local markets was in part to be attributed to that fact. Until Australia is again re-stocked it does not appear to be wise to part with any ewes that are capable of throwing lambs. Since January last the price of mutton in the State has been very high, and it is many years since it was so dear. The price was never lower than 3d. per lb., and the quantity offering just about fulfilled the wants of Victoria. In fact the scarcity at one time became so acute that some of the large retail butchers were seriously considering the advisability of importing mutton from New Zealand in order to keep supplies moving. Unexpected relief came in June last, when 3,500 carcases of mutton, which were damaged by water and smoke by an

outbreak of fire on the s.s. "Wakool," were landed in Melbourne and sold. This mutton fetched 2⅝d. to 3¼d. per lb., and at no other time but at a period of scarcity would it have been possible to have realised such prices for damaged carcases.

In 1902-3 the number of lambs exported was 106,199, and the average weight was about 32 lbs. In 1903-4 98,317 lambs were exported, the prime carcases averaging 34 lbs., seconds 32 lbs. In 1902-3 219,451 carcases of mutton were exported, the average weight being 42 lbs., and in 1903-4 65,640 carcases were exported, the average weight being, prime 47 lbs., seconds 44 lbs. The prices realized in London for lambs were—prime, 4¾d.; seconds, 4¼d.; mutton—prime, 4d.; seconds, 3¾d. There was a decided drop in the prices compared with 1902-3. Prime lambs then fetched 5⅜d.; seconds, 5d.; prime mutton, 4½d.; seconds, 3½d. to 4d. A large quantity of our mutton in 1903-4 found its way to Mediterranean ports, where higher prices were realized than in London. Victorian mutton and lambs commanded a higher price in London than the exports of New South Wales and Argentine, but it was lower than the New Zealand prices, for, in New Zealand, sheep husbandry is practised on different lines to those obtaining in Victoria. There, fodder plants are grown to fatten sheep, and sheep for export are raised on comparatively small holdings, here sheep have to run over large tracts of country and depend entirely on natural provisions.

A uniform system of grading mutton and lamb for export should be adopted by all shippers. The difference in weights of the various grades causes endless confusion in London. Business would be greatly facilitated if a uniform system of grading were adopted throughout, and if the same grading marks were employed by all exporters. Lambs should be graded as follows:—Under 32 lbs. marked U, 32 to 42 lbs. marked A, 42 to 50 lbs. marked B, all over 50 lbs. should be marked Tegs. Mutton carcases should also be graded. In my opinion this would facilitate sales in London and save shippers' money, as there would be less handling. This is a matter which should be seriously considered by shippers. The reports last year from London concerning the condition of our mutton and lamb were extremely favourable.

The volume of the total meat export trade and its values to Victoria can be gauged from the following figures. During the year exports were:—

Mutton and lamb	5,871	tons ..	value	£191,647
Frozen beef	706	,, ..	,,	24,724
Pork	64	,, ..	,,	3,591
Rabbits and Hares	9,380	,, ..	,,	167,914
Meat sundries	44	,, ..	,,	1 484
Fresh & smoked meats.. ..	2¼	,, ..	,,	747
Canned meats	1,330	,, ..	,,	51,770
Salted meats	96	,, ..	,,	6,211
Game	1½	,, ..	,,	216
Poultry	140½	,, ..	,,	1,853
Ham and bacon	1,437¾	,, ..	,,	137,971
Total	19,073 3/10	tons	Value	£588,128

It may be interesting to learn that in Britain in 1903 there were 11,408,560 cattle and 29,658,840 sheep, and that in the same year there were consumed in the United Kingdom, 665,679 tons beef and veal and 306,241 tons mutton and lamb, the products of that country. There were also imported during the year for food purposes 522,246 live cattle and 354,241 live sheep; 154,202 tons of chilled meat from America and the continent, and 254,608 tons of frozen meat from Australia, New Zealand and the Argentine. Of the 254,608 tons, 12,946 arrived from Australia; 109,763 from New Zealand, and 131,899 from the Argentine. Expressed in carcases the Australian shipment represented 213,880 carcases of mutton and 264,157 carcases of lamb, of which Victoria sent 87,104 carcases of mutton and 146,400 carcases of lamb. New Zealand sent 2,426,081 carcases of mutton and 2,157,679 carcases of lamb. In 1903, 2,652,570 lambs and sheep were slaughtered in Victoria for trade purposes, and their value would be something like £1,600,000. In addition the wool clip was valued at about £1,950,000. In the same year 198,776 cattle and 36,508 calves having a value of about £1,180,000; and 164,745 pigs valued at £450,000 were also slaughtered. It is reckoned that there were 515,179 dairy cows in the State and that they yielded something like 173,224,000 gallons of milk having a value of about £3,609,000. The weight of butter exported was 13,470 tons, valued £1,252,649, and in addition 584⅖ tons of milk (fresh, preserved, and concentrated), valued at £26,538, and 808 tons cheese valued at £50,773 were also exported.

Poultry Industry.

The export of frozen and canned poultry now that South Africa is not making inquiries for these commodities has received a set back. During the South African war, when the whole country was convulsed, and when its internal trade and agriculture languished, it was to be expected that attention would be turned to other markets of the world whence supplies could be drawn. Now that peace prevails and the farmers of that extensive country have gone back to their ordinary pursuits, it is not likely that in a country where poultry thrive without especial care, we can again look for markets. Russia, the United States, and Canada pour annually enormous quantities of poultry and eggs into Great Britain, and we, who are separated from the English markets by half the circumference of the globe, cannot hope to contend with nations having more favourable geographical situations in supplying Britain cheaply enough with either eggs or poultry. The poultry industry of the State last year was valued at £2,094,434.

Rabbit Industry.

Rabbits, according to reports, are proving a great pest in New South Wales. It is declared that land owners in that State have had to abandon their properties on account of their depredations. The government of that State has been approached and asked to take steps to abate the evil. Some idea of what a scourge they can become, if their development is allowed to go unchecked, can be

obtained when it is calculated that a single pair of rabbits, if left undisturbed, is capable of augmenting its numbers to upwards of 1,000,000 in two years. In this State the rabbit pest has, without a doubt, been turned into a profitable industry. In Victoria the trade in frozen rabbits, notwithstanding the many risks commercially that surround it is still in a fairly flourishing condition, but there appears to have been a slight slump in prices in London during the year. In the Mitta-Mitta district rabbits have come to be somewhat troublesome for the district is too remotely situated to permit of the safe transport of trapped rabbits to Melbourne, so the land owners there have combined together and have decided on the erection of a rabbit preserving works at Corryong. In a little while the nuisance will be abated and the means to have accomplished the end will have proved remunerative to those whom the enemy threatened. New works for dealing with rabbits are also to be erected at Wodonga, but there rabbits will be frozen as well as preserved.

New Freezing Works.

Besides the new freezing works to be erected at Wodonga, where rabbits only will be treated, Mr. William Angliss has announced his intention of erecting a large freezing works near the railway line, Footscray, where he will treat all kinds of frozen products. He is going to spend £70,000 on the works which will be built on the most up to date scientific plans and he intends installing two 60 tons Linde refrigerating machines. His abattoirs will permit of his killing 3,000 sheep a day and the freezing chambers will have a storage capacity of 100,000 carcases of mutton, or 2,220 tons of meat.

Damage to Stock from Grass Seeds.

Besides having to contend with droughts, diseases, and the depredations of rabbits, graziers have another formidable enemy, engendered by propitious seasons, to reckon with. Lambs running on lands where the grasses are long and the seeds spearlike, often sustain considerable injury through the seeds penetrating their skins. Grass seeds are a terrible scourge to graziers. At seat of entrance of seed there is inflammation ending in pustules. When the pelt is removed many seeds are found sticking in the subcutaneous tissues, and it is observed that the inflammation has extended deeply into these structures. The carcase often presents an appearance as if the animal had suffered from an eruptive disease. The damage done to lambs by grass seeds is tremendous and so long as the present system of sheep husbandry continues there is not likely to be any means of preventing it. In consequence of the inflammation caused by the seeds being so extensive many carcases are annually condemned.

As time progresses and pastoral lands become more valuable and when huge tracts of country are split up into smaller areas and when water is better conserved and the supply more certain, and when

grasses and other fodder plants are more extensively sown to feed sheep, then perhaps the grass seed trouble may be relegated to the regions of oblivion.

It is worthy of remark that there is in Victoria a steady tendency towards the voluntary breaking up of large estates that were formerly used as sheep runs into dairy and other produce farms Again in many districts the native grasses have been eaten out and no attempt has been made to improve the pasture lands. The lands where grasses are commencing to fail should be dressed with fertilizers, and good fodder grasses should be sown. In the more favoured districts where rainfall is certain it is a pity neglect in this important part of the industry is so manifest. The value of pastoral productions for the year amounted to about £6,250,000.

Canned Meats, Jams, and Fruits.

During the year it was noticed that the percentage of "blown" tins in meat and jams was something out of the ordinary, and sample tins have been collected with a view of tracing the causes. This work will be carried out as early as possible. A previous experience revealed the cause to be an anaerobic germ that was capable of withstanding high temperatures. Higher temperature and more prolonged sterilisation will no doubt get rid of the evil.

With jams and canned fruits it has been observed that if they are boiled for a certain length of time at one season they can be safely canned, but at another season a similar period of boiling fails to sterilise the product. The condition is due to bacterial influences, and higher temperature and a longer boiling get rid of the mischief in jams. Jam makers are not too fond of the prolonged boiling, for the longer the jam is boiled the more water is driven off and the less the weight of jam obtained at close of operations. To know the safe length of time to conduct the operation is the secret in making the commodity.

Preserved Glands.

There is a demand in Europe, for medicinal purposes, for certain glandular structures derived from animal sources, and I have encouraged a reliable firm of packers to collect and preserve certain glands for export. The thyroid, pancreas, suprarenal capsule and spleen have been successfully packed, under my directions, and the thymus will be collected in season and also canned. This industry, if conducted on proper lines, should turn out a profitable one.

Bonedust, Bonemeal, Etc.

The bones, bonedust, and bonemeal arriving from oversea ports received due inspection, and the factories created quarantine grounds, at which such were treated, were periodically inspected. The following table indicates the quantities imported into Victoria since January 1st, 1903, and the commodity exported indicates such as required certification before the State to which they were consigned would permit them to land.

—	Imports.			Certified Exports.		
	January 1 to June 30, 1903.	July 1 to Decem'r 30, 1903.	January 1 to June 30, 1904.	January 1 to June 30, 1903.	July 1 to Decem'r 30, 1903.	January 1 to June 30, 1904.
	Bags.	Bags	Bags.	Bags.	Bags.	Bags.
Bones	4,098	2,561	4,379	—	—	—
Bonedust	6,049	13,368	4,487	11,120	22,508	11,134
Bonemeal	3,000	—	14,863	1,554	50	5
Superphosphate ..	—	—	—	1,300	—	105
Blood manure ..	—	420	11	—	1,880	768
Digester refuse ..	—	4,002	115	—	—	—

In 1903-4 the area of land under cultivation in Victoria was 4,021,590 acres. Producers in Victoria now expend something like £250,000 per year in artificial manures, and the value of the agricultural products raised was £8,512,125. Of the above amount something like £1,500,000 was derived from the produce of orchards, vineyards and gardens, of which there were 88,415 acres in 1903.

There were exported in 1903-4—

Fresh fruits..	607⅕ tons ..	value	£81,692
Dried fruits..	1,260 ,, ..	,,	56,768
Fresh vegetables	2,248 ,, ..	,,	10,691
Dried & concentrated vegetables ..	17 ,, ..	,,	1,029
Preserved fruits & vegetables ..	1,402 ,, ..	,,	30,799
Fruit & vegetable pulp ..	1,410¾ ,, ..	,,	27,675
Honey	48⅕ ,, ..	,,	2,276

Poultry Inspections.

The following table furnishes particulars of the number of poultry inspected since January, 1903. Nearly all the birds examined passed through the auction rooms in the city of Melbourne, and the figures furnished afford some general idea of the poultry trade in the city.

Kind of Produce.	January 1 to June 30, 1903.			July 1 to December 31, 1903.			January 1 to June 30, 1904.		
	Inspected. Head.	Passed. Head.	Condem'd. Head.	Inspected. Head.	Passed. Head.	Condem'd Head.	Inspected. Head.	Passed Head.	Condem'd. Head.
Fowls ..	167,885	167,650	235	71,156	71,079	77	127,093	126,987	106
Ducks ..	26,919	26,919	..	23,399	23,399	..	28,631	28,631	..
Turkeys ..	17,766	17,758	8	23,756	23,756	..	14,411	14,411	..
Geese ..	3,497	3,497	..	12,710	12,710	..	479	479	..
Pigeons ..	1,175	1,175	..	406	406	..	4,798	4,798	..
Quail ..	60	60	..	..	..	..	..	..	..
Guinea Fowls	5	5	..	4	4	..	..	..	..
Snipe ..	..	..	..	36	36	..	..	..	..
Other birds..	..	..	..	..	..	..	106	106	..

Disease in Animals.

Diseases in Sheep.

During the year I was engaged investigating the nature and causes of serious outbreaks of disease among sheep, and in inquiring into various complaints amongst stock.

Two distinct diseases prevailed in sheep during the autumn and winter—(1) Pneumo-enteritis or contagious pneumonia, and (2) liver rot or fluke.

Pneumo-enteritis extensively prevailed in Victoria, New South Wales and Tasmania. I succeeded in isolating and cultivating the germ that causes the disease. The germ in the blood and in sections of organs of sheep dead of the disease is rod-like, motile 3 to 5 micro-millimetres long, grows well in gelatine and agar under aerobic as well as anaerobic conditions.

The guinea pig is not harmed by the disease, but the pigeon is. Large doses of blood from a sheep dead of the disease kill the pigeon, but cultivations have not a lethal effect. Cultivation of the bacillus attenuates its virulence. Sheep inoculated with cultivations suffer only a slight transient illness.

In 1834-5 there prevailed in New South Wales as an epizootic a disease called epizootic catarrh. It caused the death of 50 per cent. of the animals attacked. Judging from the description furnished of the disease, it is identical with outbreaks I have been investigating. A full account of the disease and of the experiments conducted will be published in the *Journal* in due course. At present various experiments are being conducted to endeavour to procure a prophylactic vaccine.

Liver rot, fluke, or fascioliasis is causing much concern to sheep-breeders. It is prevailing widely on damp, marshy tracts of country, and the mortality is fairly great. The disease is due to liver flukes *(Distomum hepaticum, Distomum lanceolatum)* in excess in bile ducts of the liver of sheep. A full description of the disease, with illustrations and methods of prevention, as well as treatment of affected animals, will be published in a subsequent issue of the *Journal.*

Multiple abscesses in sheep—the germ of which I described in a report furnished to the department in July, 1898—are occasionally encountered in sheep at the abattoirs. This coming season I apprehend the disease will be a source of great trouble. In wet seasons it is noticed that it is very prevalent, and exceptional care will be required in inspecting sheep for export to see that no abscesses are left in the carcases and to reject those badly affected.

Foot rot made its appearance in some districts, but the disease with care is one that can be kept under control. Paring the feet and driving the sheep through arsenical and copper foot baths is the treatment. When the sheep are unable to walk the feet should be pared and dressed thrice daily with the solution.

Fowl Tick.

Fowl tick has been steadily combated during the year and from many farms it has been eradicated by the efforts of Inspector Smith and the various police officers acting as tick inspectors. The pest fortunately has been kept well within the restricted areas and from Hopetoun and Goyurra, which districts have been placed in quaran-

tine, it is hoped to be soon exterminated. An officer is to be sent to Hopetoun to cause its eradication from those few premises in which it is known to exist. In my last report I mentioned that when the railway to Mildura was opened it would be necessary to place Mildura, where tick has long prevailed, in quarantine, and the recommendation has since been carried out. Senior-constable Carter and Mr. McLeod have been appointed to control the evil there and from reports to hand good work has already been done.

The disease made its appearance at St. Kilda in March last, and no time was lost in having it stamped out in that locality.

The maintenance of the restrictions on birds coming from New South Wales and South Australia and from our own quarantined areas has certainly prevented the general infestation of Melbourne, and on no account should the present regulations be relaxed.

Roup and Avian Diphtheria.

Roup during the year claimed many victims. This disease is due to a specific organism which I have cultivated. Many birds were brought for examination during the year and roup was principally the cause of the fatalities. Avian diphtheria was also occasionally observed.

Tricophytosis.

Mange—due to a vegetable parasite, the *Tricophyton tonsurans*—affects man, dogs, cats, horses, cattle, and other animals, and last year it was prevalent in horses and cattle. My attention was called to many cases occurring in the metropolitan area.

Swine Fever.

In 1901 it was estimated that there were 350,000 pigs in the State, and in 1903 the number had shrunk to 300,000. The cause of the reduction in the numbers is to be sought in the mortality produced by swine fever, which since I reported its appearance in March, 1903, has made its pernicious influence felt throughout the State. At the abattoirs in the metropolitan area many cases were observed indicating the prevalence of the disease.

Demodex folliculorum.

Mange in pigs caused by the *Demodex folliculorum* is not an uncommon disease. Last year I had a photograph taken of the carcase of a pig that was badly afflicted. As a rule the disease appears only in the face and head, but in this special case all parts of the body were involved.

Scaly Leg.

Scaly leg in poultry is a mangy condition that was often seen during the year. It is due to the *Sarcoptes mutans*.

Spiroptera Tumours in Horses.

Cases of *Spiroptera megastoma*—worms that cause fibro-cellular tumours in the stomachs of horses—frequently cropped up. The meal

worm (the larva of the meal beetle, *Tenebrio molitor*) which is the intermediary host in the development of the worm, is now found, extensively in grain stores and the lofts and bins of stables in Victoria.

Worms in Fish.

Worms (*Filaria piscium*) in fish, particularly the barracouta, were very common last year, and they usually infested the body cavity. Inhabiting the muscles of barracouta I found worms existing, but so far I have not determined their species.

Bitter Pit in Apples.

During the year investigations into the causes of bitter pit in apples were conducted, and from diseased fruit cultures of germs obtained therein were made.

In March last pure cultures of various germs derived from infected fruit were inoculated into Rymer and Morgan's Seedling apples grown on trees at Mr. Sell's orchard, Doncaster, and in the laboratory other varieties—Five Crown, Cleopatra, Jonathan—were also inoculated. The fruits inoculated in Mr. Sell's garden were allowed to remain on the trees for 14 days before being pulled, then taken to the laboratory for examination. Some of it was examined four days later, but no macroscopic changes were observed. The remaining apples were examined 45 days after inoculation, and in fruit inoculated with certain cultures, patches of disease in the fruit resembling those noticed in apples that contract the disease spontaneously were noticed. The control fruit shewed no such changes.

Further investigations are necessary before any definite information can be announced as to the cause of the disease, and the work will be prosecuted as opportunities are presented.

Phosphorescent and Slimy Meat.

During the year phosphorescence on meat and in butchers' shops prevailed extensively in the metropolitan area. The luminosity was due to the *Bacillus pflugerii*, and in a lecture delivered before the Butchers' Association I indicated the steps to be taken to eradicate the disease. Besides touching upon phosphorescence, I dealt with such subjects as sliminess on meats, the proper manufacture of brines, and the abuses of preservatives in various goods.

Sliminess is a serious trouble in factories. I had occasion to visit and report upon this condition in a country bacon factory. I isolated from the diseased meat, and from the brine tanks, wells and water tanks an organism, identical with the *Bacillus viscosus*, which created the trouble. By adopting certain measures the trouble can be got rid of.

Office Work.

Considerable correspondence with producers in various parts of the State on technical subjects was dealt with and the matters treated upon required either answering by myself or at my dictation. In this connection Mr. Crate's services were found absolutely necessary as otherwise the work could not have been promptly executed.

REPORT OF THE BOTANIST AND CURATOR OF THE NATIONAL HERBARIUM.

J. G. Luehmann, F.L.S.

The work in the National Herbarium during the past year has been principally of a routine character. The arrangement of the non-Australian plants has steadily progressed according to Bentham and Hooker's *Genera Plantarum*, and will be finished in a couple of months up to the end of the Phanerogams.

A complete list is made and also an alphabetical index. The shelves are carefully numbered, so that there is no difficulty in finding any desired plant. The species I have been compelled to sort alphabetically, as being most convenient under present circumstances. The whole of the late Dr. Sonder's collection, purchased years ago by the Government, has been incorporated in the original herbarium and put into the same paper, and so have also the many thousands of plants received during the last 35 years, but not readily available before for comparison. We have now, I believe, the finest collection of plants south of the equator, for future reference by any botanist.

I may mention that I found in Sonder's collection specimens gathered more than 200 years ago in a good state of preservation; they were described by Mr. Petiver in the Philosophical Transactions of the Royal Society at the beginning of the 18th century. They are partly from India and partly from North America.

Regarding the Australian collection, which is of course the finest in the world, there are still many thousands of unnamed specimens, but they are nearly all placed into their respective orders and genera. They do not offer much new material, as the late Baron Von Mueller had such a wide and profound knowledge of our native vegetation that he would generally see at a glance whether a plant was new to science or required investigation, though of course he could not with certainty name all the collections he got and they were simply sent to the herbarium without names, as supplements. The Australian collections are arranged according to Baron Von Mueller's Census of Australian Plants, similarly to those from outside the Commonwealth, but in this case the species are sorted systematically, at least the great majority. The classifying of the immense number of unnamed specimens will occupy much time yet but will have to be done, though the results may be small. There are very few duplicates left, and thus I have not been able to do much in the way of interchange, for our plants near Melbourne have been sent away so frequently that they are of no value to any large botanical establishment, and specimens from the north and the interior of Australia are expensive.

In order to guard the collections against the ravages of insects they are placed in large iron boxes and then subjected to the vapours

of bi-sulphide of carbon for two or three days; the result is satisfactory, as rarely an insect is found, except on recently received specimens. It takes about a year to thus treat the whole collection.

In connection with the above I beg to mention the valuable services rendered by my assistants, Messrs. Tovey and Audas; both have been most assiduous in the performance of the work allotted to them and regular in their attendance.

Visits to the herbarium are not very frequent from people who desire information on different subjects, but occasionally they take up a good deal of my time. Owing to bad health, arising from prolonged insomnia and other causes, I have been unable to do much progressive work, nor even to name plants for correspondents expeditiously, but my health is gradually improving and I hope to be able to do more justice to the Agricultural Department as well as to myself in future.

The work on the Grasses of Victoria will, I trust, be finished within a few months; it is only in the evenings at home that I feel able to devote myself to it for an hour or two.

With the aid of Providence and a naturally strong constitution I hope soon to regain my former health and thus be able to give a better account of the progressive work of my Branch next year.

REPORT OF THE WORK OF THE FORESTRY BRANCH.

A. W. Crooke.

Notwithstanding the general assumption to the contrary, good forest conservation work has been achieved during the year under trying and difficult circumstances. Such unpopularity as attaches to the branch doubtless arises, to a great extent, from the fact that system has been introduced into the exploitation of nearly every class of forest produce.

The strong efforts that have been made to improve the reserves and conserve timber for a continuity of future, whilst adequately providing for present requirements, necessitated the imposition of restrictions and proper modes of conversion that are strenuously objected to by many of the persons immediately interested.

Though there is a cry, it may be properly doubted if there is any very strong popular feeling for systematic and regulated forestry at present, and every improvement has to be fought for to obtain and retain. If there really is a general desire for true forestry at this juncture, the experience of the writer is that it is not made manifest by the bulk of the people and industries most vitally concerned.

Other countries did not awake to the value of systematic forestry until their forests had almost entirely disappeared. Our areas have been going fast for many years, and only the future will be able to tell if we have continued to slumber.

Very many valuable forests have been lost, never to be regained; still there are enough left to supply the timber needs of the community in perpetuity—if they are spared to us—and sufficient strength is given to the administration to withstand the everlasting encroachments of interested persons and corporations. However, it is most gratifying to note that the Government is seriously taking the matter in hand, and that consequently there is more than a fair chance of a Forest Act. One is sadly needed.

Under present conditions, bar one or two inadequate sections of the Land Act, the whole business is conducted under regulations by the Governor in Council. These are more or less easily made, according to circumstances, and quite easily unmade or altered. They give no kind of security for consistent administration or fixity of purpose.

Alienation of Forest Lands.

This is a depressing subject. Alienation of these lands has been going on steadily, and sometimes furiously, year after year, since the creation of a Forest Branch, and the past year has only differed from its predecessors in degree. Much of the time and energy of the administration has been taken up in battling for the retention of

areas that should, in its opinion, be retained, whilst it freely acquiesced in the excision of country—worthless from a forest point of view—hastily reserved in the long ago in response to a then existing forestry cry.

Large timber royalties are now being obtained by private persons from "selected" land, and repeated applications have been made to the Lands Department during the preceding twelve months, palpably for the timber on the areas applied for, because, less the timber, the land is worthless.

It cannot be too strongly urged that the alienation of land bearing fine natural forests is a perpetual loss to the State. It is pleasing to record that, by direction of the Hon. the Minister (Mr. Murray) this alienation has been stopped for the time being.

If the law, or the elastic reading of the existing law, were altered so as to retain in the Crown the property in timber, for purposes of exploitation only, on all selected land until the fee simple was granted, poor land bearing valuable forest produce would be much less keenly sought after, or not at all.

In this connection it is suggested that surveyors when surveying blocks in the vicinity of forests should be instructed to provide proper outlets for the timber. This has been neglected in the past, and in many districts, particularly Warburton, sawmillers have to pay what practically amounts to blackmail, to selectors for the privilege of running a tram through their ground.

Royalty System.

The policy of bringing the whole State under this system has been steadily pursued during the year, and it may be fairly anticipated that the time is not far distant when all forest produce will be exploited under it. The system is fair, and deterrent of waste, whilst the old priced license system was eminently inequitable and made for waste of the worst kind.

Under royalty the necessary supervision presses very heavily on the limited staff, but under priced licenses effective supervision is practically impossible, and all said and done, effective supervision plays the most important part in any scheme of regulated forestry. Compared with the adjoining State, our royalties are very low, but this matter is now under immediate consideration of the Director.

Grazing.

The present position is quite unsatisfactory; grazing on all lands classed State forest and timber reserves should be immediately under the control of the forest administration, and made subsidiary to the larger forest interests. The fees—a legitimate source of revenue in all recognized forest systems—should all be credited to us.

The existing system—or want of it—provides that some grazing licenses are issued by this Department and some by the Department of Lands; and it has not always been possible to convince the latter

that the reproduction of valuable eucalypts in State forests is of more importance than grazing fees. Such reproduction has been retarded, and sometimes almost stopped, by relentless grazing.

Licenses too, for long terms, are not conducive to forest interests and might with propriety be avoided in the future. They make for forest fires, under which head this is also referred to. Whenever practicable, agistment is preferable, as under it the temptation to the individual is not so keen.

Forest Fires.

Serious forest fires were anticipated last summer. All the conditions were favourable to them, but happily heavy rains came at unexpected times and they did not occur. Stringent precautions were taken, many miles of necessary breaks made, fire prevention literature freely circulated, circulars and posters sent to country schools, and forest stations effectively equipped to cope with the fires that did not break out. But neither the labour nor the money is lost. It might be possible, and profitable, to arrange with the Director of Education for the State school teachers generally to give a lesson to their pupils during the month of December in each year on the "Careless use of Fire." About the same time a simple article might be written for the school papers on the same subject.

The money value of the timber destroyed annually by forest fires cannot be estimated or calculated, but it must be very great indeed, and no trouble or expense incurred in order to minimise them should be matter for complaint.

Long term grazing licenses do not conduce to the prevention of forest fires, and a condition in such licenses that they would be cancelled on mysterious fires breaking out on the areas involved would, it is thought, lessen the number of accidental outbreaks—more care would be exercised. The fact is not generally capable of proof, but fact it is nevertheless, that forest fires are started for the sake of the grass. Thirty odd years ago the writer saw it done in the Dandenong forest by representatives of the pastoral licensee.

Sawmilling.

The majority of the mills are now under royalty, and the system is working smoothly and well. There are more mills now operating than there is full work for, and the present policy is to retain some valuable belts of milling timber and virgin forest for future requirements. They will be opened when areas at present in use are cut out and closed for a term of years. It is hoped that something fairly reasonable in the shape of royalty may then be obtained. It might prove a proper and profitable course to mark out these lands in suitable milling areas and put them up to public competition on a royalty basis, *plus* premium.

"Spot" mills continue a source of trouble, and in some instances of waste, owing to their inability to break down large logs. During the term of office of the late Acting-Conservator, Mr. H. Mackay, a

regulation was made which prevents the increase of this class of mill, and they must gradually die out.

The millers supplying the metropolis have now come to some sort of understanding as to prices on a basis of 8s. per 100 feet super. on the trucks, and are doing well. The Crown royalty is 2d. per 100 feet super.

The output for the purpose of collecting royalty is now taken from the sawmillers' books, and there is no reason to doubt the genuineness of the figures, but it is suggested as an additional safeguard against carelessness in compiling them, that statutory declarations at stated intervals should be provided.

Sleeper Hewing.

This has continued throughout the year, and has apparently come to stay. Though seriously opposed at first, in many forests it has proved a blessing in disguise. Thousands of culls and over-matured trees have been turned to profitable account that would otherwise have served no useful purpose whatever, and tens of thousands of sleepers have been obtained from trees growing on ordinary Crown lands and grazing areas that could have served no more advantageous end.

The supervision has been strict, and therefore comparatively costly. There is also some necessary waste, but part of this would be avoided if the Railway Department could be induced to accept a certain proportion of their lesser sized sleepers in their contracts for full sized ones. Frequently timber that would cut a small sleeper is left to rot, because a small one will not be accepted at any price, when the contract is for large ones.

Wattle Growing.

Plantations have been extended and new ones projected during the year. So far as we know, there is no forest tree that will produce so much in return for a given expenditure, and in so small a period of time, if all goes well. It is intended to largely increase the plantations during the coming year. The money has never previously been forthcoming to launch out so boldly. But in this, as in other things, it is well not to hasten too fast, and some degree of caution is necessary. A first cost necessitates a continued cost for a period of from five to eight years, and although the department has succeeded in its past operations, private persons who have taken the matter up as a business, and have spared neither money nor labour, have not managed to get a return.

The tree is subject to the ever present dangers of fire and disease, and it will not be for the want of trying if some efficient and cheap substitute for tan bark is not presently discovered; in fact it is claimed to have been found already. Should this prove correct, the value of the plantations would be suddenly discounted. These observations are made in connection with the numerous suggestions that the Department should plant tens of thousands of acres with this tree.

Waste of Valuable Timber.

Fairly apocryphal statements of a startling nature having been reported to have been made recently, and such statements having been widely circulated and commented on by the press, it is perhaps well to treat the subject at some greater length than the bare facts would seem to justify. These facts do not accord in any way with the somewhat reckless and even ludicrous pronouncements referred to. Still there is waste in exploiting timber, and must necessarily be. Most of it is absolutely unavoidable. There is similar waste in a carpenter's shop.

Strict regulations are made to prevent wanton waste, and these are duly enforced by the supervising staff. Of this we have had recent independent expert evidence.

Neither sawmillers nor splitters will waste material that has any market value, if they can possibly avoid doing so. There is often the appearance of waste to the casual observer that has no foundation in fact. Hewers and others, after using all the merchantable portions of a tree, leave in the forests the faulty portions that cannot be made use of. They cannot do otherwise. In forests where fuel is of value, and they are many, there is no waste. There is waste of "edgings" at some mills, because there is no sale for the small scantlings obtainable from them; but these millers have been induced by the local officer to see if cutting pickets and fruit cases will cover expenses.

A certain amount of waste, and of very valuable timber, is caused by the extremely high standard set up by the inspectors of the Postal Department in judging telegraph poles. At Rushworth such splendid poles have been rejected—and consequently wasted—as almost to amount to a scandal. Some steps may have to be taken in the matter.

Judged from the standpoint of countries where every twig is eagerly sought after and has a value, there may seem to be inordinate waste, but the writer is prepared to state, after having obtained special information from every forest, that the sum of *preventable* waste is comparatively small. There was a great deal many years ago, and the evidences of it still remain, but they could not easily be confounded with the operations of later years. The waste caused by spot mills has been dealt with. However, destructive criticism is easy and—cheap.

Forest Offenders—Penalties.

The totally inadequate fines inflicted during the year for serious forest offences by some honorary benches have been a serious set back to the efforts of the field staff, who have much difficulty in sheeting home such transgressions. At present there is no remedy. Some of these fines are so paltry as to induce pilfering and other illegal practices, and make them more remunerative than honest dealing.

Possibly the new Forest Bill may contain a clause dealing with this. If a provision fixed a minimum fine for every offence, and for each succeeding one on a rapidly rising scale, offences would be more

rare. Summary recovery might also be provided for, the present "show cause" process being slow and ineffective.

A specially severe penalty should be provided for the vandal custom, in districts remote from supervision, of barking eucalypts for the sake of the bark. Local justices, from association and otherwise, sometimes have a tender feeling for the defendant, and look upon forest offences with a lenient eye.

Only recently the Metropolitan Board of Works saw reason to complain of the small penalty inflicted on a man convicted of removing timber from the special reservation adjoining the Board's property. One of the two presiding justices was connected by marriage with the culprit. This prosecution was a troublesome one, and occupied the time of three government officers in detecting the offender and securing a conviction.

Nurseries and Plantations.

The latter are looking well, and have been added to during the year. They are under the direction of a trained expert who estimates the selling value of the produce of the large plantation at Creswick at £300 per acre in 50 years' time—with some revenue between now and then—granted a continuity of effort and necessary expenditure. It may be taken from such a source that the figures can be relied on. They are alluring. But it may be reasonably questioned whether there is any very great certainty that such continuity of effort and money provision will be afforded for that length of time, and whether for so protracted a period, fire will spare our pineries, notwithstanding watchfulness and a system of fire breaks. Yet, if the Department is to produce pine timber, these risks must be taken. Some three hundred plants will be added to the valuable little valonia oak plantation this season.

The nurseries at Macedon and North Creswick have again turned out a great quantity of first-class stock for the Government plantations and institutions, for other institutions, and for public bodies generally. Many thousands of suitable young trees have also been distributed to country residents, more particularly farmers in dry districts.

As instructed, a special effort was made to meet the unexpected requisition of the Director of Education for trees for a general arbor day for all the State schools. It is in evidence that the response was satisfactory to that gentleman.

Some thirteen hundred schools were supplied with more than a total of thirty thousand trees, all perfectly packed and distinctly labelled. This, at a time of general distribution, reflects credit on Mr. J. Firth (the Superintendent) and his staff.

Improvement Thinning.

During the year this work has proceeded under strict conditions, and as close supervision as the strength of the staff permits of, with a view to improve the reserves by removing inferior and crooked growth and at the same time meeting the demand for mining timber, fuel, telegraph poles, piles, &c., &c.

Some 10,000 acres have been treated under the acreage and tonnage systems from which revenue has been derived. The latter system is the better, as being fairer and offering less temptation to overthinning than the acreage system. Otherwise, however, some areas have been overthinned from causes not under the control of the administration.

About 1,500 acres have been thinned by day labour at a cost ranging from 7s. 2d. to 27s. per acre, according to the nature of the work and the capacity of the men employed. This improvement felling, has been done when the resulting produce has little or no commercial value, but anything that has a value is disposed of.

An experiment is to be made shortly by letting this class of work by contract in suitable sized blocks to local bushmen. It was expected, and justly so, that it would be tendered for at from 30 to 50 per cent. less than day labour results from city men. Tenders will be invited in the near future, but if the prices demanded are nearly as high as the Department has now reason to suppose they will be, the wisdom of accepting them may be doubted.

Revenue.

A statement of revenue is appended. Compared with the prodigious quantity of forest produce supplied the returns may be regarded as slight. But forestry cannot be conducted on purely business principles and eleemosynary lines at the same time. Forest revenue in the past has always been made subservient to the needs of national industries, particularly mining. Strict business principles, could fairly be construed as giving nothing at all for nothing, and nothing for less than its market value, yet section 5 of the Mines Act provides that every holder of a miner's right may obtain all the timber he requires for mining and domestic purposes without payment.

It is our experience that those who get timber for nothing are more difficult to control, more wasteful, and more impatient of the slightest restriction than those who pay for it.

Many years ago the present writer—with some timidity—remonstrated on a proposed course on the ground that it would seriously affect the forest revenue. He was told by the then Treasurer, that forest revenue was not a consideration, and that the forests should be exploited for the benefit of other great industries. Though the rates are so low, the expenditure in supervision is the same as it would be if they were reasonable. When circumstances compel the timber getter to obtain his supplies from private paddocks and selections, he pays three and four times as much as he pays this Department. Scores of instances could be cited were it not for considerations of space.

General.

It will probably be necessary in the near future to close for a term of years, either in whole or part, for particular kinds of forest produce or all kinds, certain areas of forest. Wombat, Tchiree,

Creswick, Bailieston, Whroo, Benalla, Yarrawonga, Barmah Island, Heathcote, Knowsley, Crosbie, and other districts will need careful examination in this connection.

The rapid increase of dredging operations in the vicinity of thinly clad firewood areas is a cause of some disquiet. The consumption of fuel from the local Castlemaine forests for dredging last year amounted to 3,500 tons. These forests cannot long stand this strain.

The rapid increase of insect pests and parasitic growths is also a cause for some concern. The forests at Maryborough, Tarnagulla, Warrowitue, Moormbool and Rushworth are badly infested with mistletoe; in the case of Rushworth, a valuable young ironbark forest is seriously menaced. Efforts have been made to cope with this evil, and it is proposed to take vigorous measures this year. This pest however spreads into forests from adjoining paddocks and selections, and there is no present power to compel the landowners to take any action. It is suggested that this might be considered in connection with the Forest Bill.

There is little cause to doubt that the rapid increase of insect pests is directly due to the enormous mortality of insectivorous birds due to the laying of poisoned grain for vermin destruction purposes. Shooting in forests, except by licensed sportsmen, might profitably be prohibited for the sake of these birds, and also for the purpose of minimising forest fires. The small boy using shot in his pea-rifle is responsible for the death of great numbers of these valuable birds.

Ringbarking permits are responsible for much destruction of valuable timber. It would be a step in the right direction if none were granted in well timbered country, unless a competent forest officer is stationed near enough to supervise. The selector's view of what is crooked and useless timber is usually a fairly comprehensive one.

A few words may be spared concerning the new timber trophy. Under instructions from the Director—and by the direction of the late Minister—at very short notice an admittedly handsome structure has been built in the shape of a room without a roof. In preparing it, one of the objects the writer—who has for many years made articles of furniture of "common" Victorian hardwoods—kept in view, was to make evident the beauty of grain and the softness and warmth of colour of these "common" timbers, such as blue gum, red gum, mountain ash, grey box and the ironbarks, and the suitability of some or all of them for superior cabinet work and internal fittings for high-class buildings. These woods are practically unknown for these purposes, but an inspection of the trophy should convince architects and others interested that they need not go out of this State for high-class, *low-priced* cabinet woods. So little are our own woods thought of in this connection that planks ten inches wide could not be obtained in Melbourne, and, excepting the blackwood, most of the trophy was built from seasoned railway sleepers. Blackwood, of course, is well known as one of the handsomest of figured timbers, yet great quantities of it, obtained from alienated lands, are still

commonly used for firewood. The architect was Mr. G. B. H. Austin, of the Public Works Department, and the builder Mr. Kannaluik, of Queen street. Both have reason to be pleased with their effort.

The staff, speaking generally, has worked admirably during the year, many of its members taking a keen interest in their duties. The branch has long been worked under its full establishment both as to inspectors and foresters, but an increase to its paper strength is a present pressing requirement. The recent appointment of an acting inspector is a most acceptable addition.

Much valuable assistance has been again rendered by members of the constabulary acting as Crown lands bailiffs. A reversion to the previous practice of rewarding these officers for obtaining convictions is worthy of consideration, especially in the vicinity of towns where the forest officers cannot afford the time to detect forest offenders; but not on the old basis of a fixed sum per conviction. A better plan could readily be devised, but there is not space here to elaborate it.

WOMBAT STATE FOREST.

Receipts and Expenditure for Year Ending 30th June, 1904.

Receipts.	£	s.	d.	Expenditure.	£	s.	d.
Rent—Sawmills	10	10	0	Salaries and Wages of Foresters, &c.	666	15	0
,, Special Area ..	97	10	0	Forage Allowance, &c. ..	246	14	10
,, Residence	2	2	6				
,, Grazing	7	14	10				
Royalty—Sawn Timber ..	169	18	0				
,, Mining Timber ..	435	1	4				
,, Fencing Timber ..	10	18	6				
,, Firewood & Charcoal	190	5	5				
,, Beams, Piles, &c. ..	7	6	11				
,, Wattle Bark ..	11	13	0				
Sale of Confiscated Timber, &c.	13	2	4				
	£956	2	10		£913	9	10

Total Revenue for Year Ending 30th June, 1904.

Sawmills and Tramways—Rent	£1,209	11	8				
Special Timber Areas ,, ...	186	0	0				
Jinker and Faller Licences	452	0	0				
Sawmill Timber—Royalty	2,802	16	10				
				£4,650	8	6
Railway Sleepers ,, ...	..			936	19	7
Mining Timber ,, ...	..			2,245	9	7
Firewood and Charcoal—Royalty .. .	..			2,819	18	3
Fencing Material ,, ...	..			404	0	10
Beams, Piles, &c. ,, ...	..			467	12	10
Wattle Bark ,, ...	..			2,029	18	11
Grazing Fees	..			2,056	5	11
Residence Fees	..			11	5	0
Splitters' Licenses	..			614	2	6
Sale of Confiscated Timber, &c...	..			353	11	8
				£16,589	13	7

The Expenditure amounted to £16,136 8s. 3d., of which £886 14s. 10d., was provision for Melbourne unemployed.

REPORT OF THE POULTRY EXPERT.

A. Hart.

In presenting the annual report in connection with the poultry and egg industry, I might mention that the past season has not been so prosperous as could be wished, due to the fact that to some extent several of the exporters prepared and packed their poultry for export without Government supervision, packing a class of fowls which were not up to the standard of foreign requirements. The result was that Russia and Canada gained a great advantage in this trade to the detriment of the Victorian poultry industry. When the exporters shipped with no departmental supervision, treating the birds themselves, it was impossible to fill the demand for stock for the South African market carrying the Government stamp. I am glad to say that the exporters have now realised the importance of Government supervision, and are again having their birds treated and packed in the usual way. Already 10,000 head of poultry have passed through my hands, and several shipments have been made with successful results to South African and London markets. The reports received from both places describe the packing as perfect, the prices realised being very satisfactory and quite equal to those reached for best poultry from Russia and Canada.

I am informed by the shipper of the consignments to London and South Africa that his agent reports as follows:—"Packing perfect, price good, demand for an unlimited quantity with the following improvements: (1) All birds to be of uniform size and weight in each package, (2) condition should be improved by topping off for a month previous to being killed, (3) maximum age at time of export, 14 to 18 weeks old, weight to average from 3 to 4 lbs. per bird."

In topping off by natural feeding in troughs, ground oats or barley meal scalded with skim milk or milk and water, mixed in the form of a crumbly mass, should be used for the first fortnight; for the remaining 14 days let 1 lb. of rendered fat or fresh cut green bone be added each day for every 20 birds. They should have a plentiful supply of green food, grit and water, and be kept in a dry and draught-proof coop capable of holding 6 chickens. These coops should be closed with laths in the front, allowing space for the birds to feed out of the troughs placed in front of the coop. They should be liberally fed three times a day. Birds fed in the ordinary way will realise in London from 7d. to 8d. per lb., whilst those topped off as described will reach 10d. to 10½d. per lb. and are much more in demand.

All future consignments will be killed and bled, and packed in twelves keeping the weights as even as possible, whilst size and quality will also receive special attention so as to meet the latest requirements of the English and South African markets. The

average class of chickens on the market during the past season was superior to anything produced in previous years, and taking into consideration the present low price of grain and other poultry foods, it should encourage the producer to keep on improving his stock. If the right class of birds come to hand there is no fear of the market being over supplied, and our exporters have every chance of sharing in the enormous amount paid annually to importers of poultry and eggs into England, running into over £10,000,000 per annum. At the time of year when poultry are most plentiful here, they are very scarce and are consequently at their highest prices in England.

An idea of the extent of the British trade in poultry and eggs can be gained from the following facts published by the *British Board of Trade Journal*:—"The values of the imports for the past two years are—Eggs, (1902) £6,308,985; (1903), £6,617,619. Poultry, (1902) £1,059,044; (1903) £1,203,086." The increase in the value of both items last year over 1902 was £452,676, Russia and Denmark taking the lead in the export of eggs. The quantity of eggs imported last year was 2,271,661,560, representing an average expenditure of 18s. for each household in foreign eggs. This is exclusive of eggs sent from Ireland. The estimated value of the total consumption of eggs and poultry in Great Britain during 1903 was £17,420,705 divided as follows:—Imported, £7,820,705; Irish, £2,300,000; British, £7,300,000. The weight of eggs consumed last year is estimated at 250,000 tons, and the poultry at 65,000 tons. Of the eggs used, it is considered that about five per cent. were purely for manufacturing purposes, one firm in London using at least a million per annum, although its product is not a food.

Time for Exporting.

The best time for exporting so as to command highest figures for chickens or ducklings is to land them in England from March to June, while turkeys should be sent during September or October, and must be on the London market before Christmas. Either turkeys, chickens, or ducklings may be killed when in prime condition, and can be kept in cool chambers till required for exportation. The weight of turkey gobblers should be from 12 to 20 lbs., the heavy weights being in the most demand, providing the condition is up to the mark. Turkey hens should run from 7 to 10 lbs., and no birds should be over 12 months. Chickens should be from 3 to 4½ lbs., and their age from 14 to 18 weeks; ducklings should average about 4 to 4½ lbs., and they should not be more than 10 to 13 weeks old. Nothing but high conditioned birds should be sent. Liberal feeding will encourage weight, and the sooner the birds are ready for the market the less will be the feeding bill. All classes of poultry intended for export should be put up and fed with suitable food, so as to induce both growth and condition.

The use of the crammer in rearing poultry will enable breeders to force their chickens on rapidly, but can only be recommended where poultry is kept on a large scale, or where birds are wanted to catch a particular market. The food for the crammer must be of the

consistency of porridge. It can be made of ground oats and barley meal mixed with skim milk and no water is required with it for drinking purposes.

Watering Poultry.

I would like to draw the attention of our city auctioneers to the importance of providing the sale coops with drinking accommodation for all poultry sent in to market. This matter requires attention, as it is well known that birds sent on long journeys without water will not kill a good color, which is against success in freezing, preventing them from showing the whiteness desired.

Exporting and Storing Eggs.

The British markets still offer an unlimited demand for eggs, and Victoria should endeavor to furnish a portion of the supply required. The shipments made to foreign markets during last year were not a success, as they were sent as ordinary cargo, no cool storage being available.

During the past season about 100,000 dozen eggs were put through the Government Cool Stores with very satisfactory results. The eggs were placed in the chamber when their value was from 8d. to 9d. per dozen, and they realised from 1s. 1d. to 1s. 2d. per dozen when sold. The success of keeping eggs in this manner is now assured and must certainly prove a benefit to the industry as the consumer can rely on getting a fresh egg at any time of the year. The perfecting of this process must be credited to the Department, as other previous trials were not a success. A large number of persons interested in the egg industry took advantage of the Cool Stores, and the quantity of eggs stored was very satisfactory. One point to be observed in selecting eggs for storage is that they must be perfectly fresh or satisfactory results will not be obtained, as they will come out in exactly the same condition as they are put in. Eggs should be perfectly clean and this can be effected by the use of suitable nests for the hens.

The packing of eggs sent in to market is much better than it was, the musty chaff, sawdust, &c., formerly used having been replaced by suitable packing, the producers receiving many valuable object lessons in this respect at agricultural shows where the departmental exhibit was on view. The egg filler brought out by the Department to suit any box similar to kerosene cases is now very popular, and its cost is trifling, being only about 7½d. per case. It permits of 25 dozen eggs being packed and kept free from taint of any kind. The filler can be compared favorably with anything made of the kind, and on comparison with an American article used very largely in that country, it was found to be ahead in every respect.

The requirements of our State egg production must in the future demand an outside market to cope with the supply. Cool storage is the only certain method of making a successful export trade, and the provision of cool chambers by ship-owners would be a boon to the

industry. The Government might, with advantage, secure these chambers, when they could allot space in them as required. The great benefit to be derived from cool storage would be the extension and improvement of the trade outside our own State.

Agricultural Classes.

During the past year these classes have been well attended, and very much interest has been taken in the valuable object lessons afforded. Demonstrations and lectures have also been given at the various centres in the State, when all branches of the poultry industry were thoroughly explained. The best breeds, both for pure stock or crossing, were shown, and samples of meal, grain, grit and shell were on view. Models of troughs, dust-baths, and all other poultry appliances were exhibited, including the crammer, which is used so successfully in Surrey (England), this county commanding the highest prices for chickens.

During the past year I have planned out more poultry yards, and visited more farms than in all previous years put together, and the prospects of the poultry industry can at present be said to be in a very favorable condition, providing much encouragement to those engaged in it.

REPORT OF THE DAIRY EXPERT.

R. Crowe.

I have pleasure in submitting a *resume* of the chief features of last year's work in connection with the dairying industry and the Government Cool Stores.

In the July number of the *Journal* appeared an article by me entitled "A few lessons from the past butter season," which contained matter that might, perhaps, more appropriately be incorporated in this, the annual report. In that article I mentioned that butter of the approximate value of £1,500,000 was exported. I also pointed out that our having to begin the season with old stored butter, and to re-open business connections, together with the necessity for lower shipping temperatures, accounted for the disadvantages experienced on the London market. Yet, notwithstanding these serious drawbacks, the season cannot be regarded as other than satisfactory. Many of our factories secured averages of 98s. per cwt., a price higher than the most competent authorities anticipated twelve months ago.

Quality of Victorian Butter.

Notwithstanding all that has been said regarding the industry generally, and the quality of Victorian made butter in particular, it should be remembered that at the Islington Show held by the British Dairy Farmers' Association at the Royal Agricultural Hall, London, from the 6th to the 9th October last, Victorian butter gained the whole of the six money prizes and four medals offered for competition in the sections for colonial produce.

As it came forward for export the butter was in most cases fully up to the standard of previous years, particularly with regard to factories receiving milk direct from the suppliers. There were, however, some exceptions in this class. Factories dealing with cream showed but slight improvement, except in some three instances where it was paid for on a differential basis according to condition at the time of its being brought in, a practice which had the effect of securing more frequent deliveries. Companies which do not differentiate in price have made no headway whatever, nor are they likely to unless they take steps to ensure that their supply shall be delivered in better condition. Even at the risk of being accused of repeating the advice *ad nauseam*, I must again insist that it is impossible to make good butter from bad cream, and before any improvement can be effected steps *must* be taken to ensure the delivery of cream in good condition.

Dairy Inspection.

Both Messrs. Archer and Carroll report very little headway in regard to dairy inspection, owing to the want of a uniform and compulsory system of working among the different municipalities.

In the March number of the *Journal* I dealt with this subject at some length, since when the matter has received considerable attention. The Department drafted a bill dealing with the subject, and the municipalities in the Western District, which were doing good work in this direction, also met and drew up a scheme which was considered in conjunction with the department's bill by a committee from those bodies and the executive of the Dairymen's Association. This conjoint scheme was referred to all dairymen interested, and the resulting concentration of their united wisdom is now embodied in a scheme to be submitted to a meeting of the principal people connected with the industry to be held in Melbourne at the end of August during Show week.

Although dairy supervision has been legislated for in the Health Act for 14 years, and its general application has been strongly urged by us for the past 10 years, very little was achieved. Now, however, there appears to be a probability of something being done that will effectually meet the urgent requirements of the case. Proper dairy inspection would do more to raise the quality of Victorian dairy products than anything else that could be conceived.

Instructional Work.

As usual butter was inspected prior to export and points allotted according to quality. Whenever a falling off in the standard of any brand was noticed, reports were forwarded immediately to the managers concerned and advice tendered as to remedial measures. If an improvement was not made as the result of our correspondence one or other of the dairy supervisors was sent to make inquiries and personally indicate the remedy. Much good was done in this direction and a great deal more could have been effected had our staff been sufficient to cope with the growing requirements of the industry, especially in the export season of the year. Instances might be quoted where factories turning out up to 10 tons of butter per week were lifted by these educational means, from making an inferior butter into turning out a superior article, to the extent of an extra £5 per ton in value. As most of our factories have now been in existence for from 10 to 14 years and are built of wood, the liability to pollution is increasing according to age It is very important that when trouble in the shape of contamination of buildings or plant, or general neglect on the part of suppliers occurs that expert advice should be available immediately, as its continuance for even a few months would possibly mean the loss of the price of a new up-to-date factory, and the embarrassment of the company.

Grading Butter.

At the commencement of the season some of the butter factories requested the Department to grade and stamp their export butter as either "Approved for Export, 1st Grade," or "Approved for Export, 2nd Grade," and so on. As some exporters appeared unaware that the Department would undertake to grade in the absence of legis-

lation, a circular was sent to all shippers informing them that it would be done wherever it was desired. Twenty-two factories applied to have their consignments graded and stamped prior to shipment. This was done, and certificates sent to the companies weekly showing the result, many factories expressing themselves as highly pleased with the value of these detailed reports and all requesting that the grading should be continued. In a few instances, however, the object of the grading appeared to be misunderstood, it being thought that higher prices would be secured for the butter in consequence of its having the grade stamp on the boxes. This of course is too much to expect straight away. In the course of time when buyers become acquainted with its meaning they will recognise the advantage by giving higher prices. The primary object is to divide the butter into recognised standards according to quality and to immediately furnish managers and directors of factories with an independent statement indicating the relative grade to which each of their consignments had attained. For instance, if a slight falling off in quality were noticed they could then at once ascertain the cause and institute remedial measures. To send reports, without stamping the butter accordingly, would not fully meet the requirements of the case as the difference between a butter scoring 94 and that receiving 93 points would not so forcibly stimulate the makers into action as would an additional intimation that their butter had been branded second instead of first grade. The allotment of points fulfils the instructional function of grading, but the branding is the lever which compels prompt action towards improvement. In the absence of this clinching demonstration a falling off is only realised when the season is far advanced and prices and reports begin to arrive from London. It may be pointed out that considerable risk is run by the officers of the Department through the adoption of voluntary grading, because some of the best factories have not yet asked for the system to be applied. The first grade stamp embraces butters varying in price to the extent of nearly 1d. per lb. so that it will be seen that good sound butters are included in the same classification as the choicest—a fairly wide range—some of the good sound brands being graded, whilst a few of the choicest are still being shipped as "Approved for Export" only. Therefore, in the face of a comparison being made at the London end between two brands, one bearing the stamp "Approved for Export" only, the Department runs the risk of having the judgment of its experts ridiculed, so that it is to some extent doubtful whether voluntary grading will affect the object aimed at. At any rate, it appears as if much good cannot be achieved until the majority of our factories request that their output should be graded. The reference made elsewhere to the good which has attended the compulsory system of grading adopted in New Zealand will fully indicate the desirability of its introduction here.

Sterilised Water.

During the past season 29 samples of water were received from butter factories for bacterial examination and nine for chemical

analysis, all of which, with two exceptions were contaminated to a greater or less extent, and therefore unfit for the making of a good keeping quality of butter.

The tests were made by Dr. Howell, Chemist for Agriculture, and it is evident that a very great proportion of the water now used should be sterilised by filtration, or heating, or both. Three years ago many butter factories installed high pressure filters for the treatment of all water required for the rinsing of cream-cans and utensils, and the washing of butter. When in good working order these filters perform their work efficiently, but to keep them in good working condition regular attention is required. Where batteries are changed daily, or oftener when necessary, and sterilised before use each time, good results have been obtained. At many places where installations exist it is not uncommon, however, to find unfiltered water used extensively. Sometimes even the filters are only worked nominally, one of the battery candles being broken.

There are a few good filters on the market but the risk of careless use has been shown by experience to be very great. The Salvator steriliser, an apparatus recently introduced solves the problem of water sterilisation. The water is heated under pressure, and without ebullition to a temperature of 230 degrees Fahr., then automatically cooled to within a few degrees of its original temperature. Tests made of water so treated demonstrate its absolute sterility.

A modification of this system was adopted at some butter factories in the shape of a pipe within a pipe, the inner one being ½ inch and the outer 1½ inch. About 60 feet of tubing is necessary between supply tank and boiler, and 40 feet of ½ inch copper piping above the water level inside the boiler. The water passes through the ½ inch pipe to the boiler, and thence through the copper tubing, and on emerging, is connected with the 1½ inch pipe. In this way the water exchanges temperatures and saves fuel. In practice, it was discovered that the lime and magnesia contents of certain waters were so great that the precipitation on the inside of those appliances entailed the necessity for frequent cleaning. Lower temperatures were tried to escape this accumulation of deposits and yet destroy all organisms. In one instance the water was sterilised at a temperature of 175 degrees Fahr., so the question naturally presented itself whether the ordinary pasteurising and cooling appliances used in butter factories might not serve the purpose, but an installation of this kind was not a success.

Efficient filtration or heating to 230 degrees Fahr. will sterilise water but of the two methods heating, as described, yields more satisfactory results, and should be adopted by all butter factories having doubtful or bad water supplies.

Butter Boxes.

A great deal has been said recently about the supply of butter boxes. Already factory companies are securing a stock for the

coming season's requirements at a higher price than they have paid for many years past. When in New Zealand recently I made inquiries as to the supply of timber suitable for boxes and the most reliable authorities there assured me that there was at least sufficient for the demands of the next 30 years. However prices must inevitably rise because the sources of supplies are becoming less and less accessible. It is stated that immense forests of suitable timber exist in Queensland but so far little has been done to utilise them. I am told that even butter factories on the fringe of this supply do not avail themselves of it. It may be possible to eliminate both gum and sap from some of our own hardwoods and make them serve the purpose. In this direction lies a field for experiment.

Paraffining Boxes.

A number of experiments were made during the year in paraffining the inside of boxes.

The New Zealand white pine is the most suitable wood available for butter boxes, but much of it has a strong sappy odor especially when wet. A little steaming when cleaning discloses the extent to which this woody flavor is present. When any butter comes in contact with such a box, it tastes quite woody, and in bad cases, the taint is imparted even through the paper.

Coating or lining with paraffin wax, which is both neutral and impervious overcomes the difficulty. The wax does not affect the flavor of the butter in any way, and the method of application is simple.

A series of galvanised iron boxes, each about 11 inches cube, are provided through which exhaust steam from the engine passes. About eight of these iron boxes are necessary to expeditiously heat the butter boxes sufficiently to properly apply the paraffin. The butter boxes are inverted over the steam boxes for heating. Although the paraffin wax melts at a temperature of 130 degrees it is necessary to have it at 200 degrees, then it is limpid enough to be applied with a brush to the inside of the box which has been previously heated. It cannot be laid satisfactorily on a cold surface. This paraffining stops the absorption of moisture from the butter by the wood, whilst, on the other hand, it prevents the wood from tainting the butter. The cost of treatment is about 1d. per box, and as less surplus in weight of butter is necessary a net saving accrues. *Pure refined* paraffin only should be used and any which contains even a trace of kerosene should be rejected. The system is coming rapidly into vogue in New Zealand and should be adopted by all factories here.

The Royal Commission.

During the year disclosures came to light in reference to secret commissions, and the evidence so far adduced shows that the Honorable the Premier was fully warranted in appointing a Royal Commission to inquire into all matters pertaining to the butter industry. It

is to be hoped now that a start has been made, all evils will be thoroughly sifted, and measures taken to remove them. It is simply astounding that butter returns may be "faked" in the manner described by some of the witnesses. Of course those against whom this charge has been made have contradicted it, but whether the imputations of juggling with tests and cream returns be true or not, legislation is essential to protect the supplier, on the one hand, and the honest trader on the other, from the possibility of misrepresentation.

Necessity for Standardisation.

Uniform methods of measuring and testing milk and cream; the licensing of all persons so engaged; a standard system of keeping books showing the amount of milk or cream received, the butter fat per test, and the commercial butter or cheese manufactured therefrom, the books to be accessible to milk or cream suppliers; a uniform method of closing butter and cheese factory accounts, the financial year to end on the same date in all cases, and the publication of balance sheets on a uniform and approved basis should be made imperative by legislation.

Dairy farmers are naturally suspicious, and reasonably so, when accounts are shrouded in mystery. So far back as 1897 I urged the necessity for a uniform system of keeping accounts and publishing comprehensive balance sheets, but secretaries did not feel disposed to take the matter up. The most pronounced opponents of the system must now admit that the farmers' confidence can only be retained by rendering unto them a clear and full account in every detail. Even at the moment of writing, a very striking case occurs to me, where the suppliers are completely demoralised because their company has persistently withheld this information.

History of Attempted Legislation.

Few are aware of the many attempts that have been made to put the butter export trade on a sound footing. As far back as the 16th of July, 1896, Mr. Taverner, the then Minister of Agriculture, moved for leave "to bring in a bill to provide for the inspection of dairy produce and other products intended for export, and to regulate the export thereof." He mentioned that at a conference in Adelaide held on May 1st, 1896, at which three other colonies were represented, the following resolutions, *inter alia,* were passed. "That uniform legislation be sought by the colonies to provide that . . . with regard to dairy produce, fruit, and wine, a uniform system of inspection and marking be adopted." Mr. Taverner said *(vide Hansard,* 29th July, 1896, page 794), "We propose under this Bill not to allow inferior produce to go out of the colony unless it is branded in such a way as to indicate what it really is." Clause 10, subsection 2 of the "Exported Products Bill 1896" provides for "inspection," "grading," and "stamping of butter," and clause 12 deals with "improperly using brands." This Bill met with such determined opposition that

it was withdrawn, redrafted, and again presented to Parliament on the 30th November, 1897, when it was proposed to have the butter branded "Factory," "Milled," or "Dairy," according to the source of manufacture (*vide Hansard*, 1st December, 1897, page 427). The Honorable Mr. Graham in supporting the Bill said "The whole of the opposition to this Bill came from one source, the middlemen of Melbourne." Mr. Bowser (*ibid* 433) stated "He would remind those opposed to supervision of the result of the absence of supervision in the Northern States of America. In 1881 the Northern States stood at the head of the market with their butter and cheese but in 1891 they were at the bottom. During that time there was a falling off of 93,000,000 lbs. of butter and 22,000,000 lbs. of cheese. That falling off was said to be entirely due to the fact that the butter export trade passed into the hands of the middlemen of New York and was so degraded by them that the value of the butter in London generally fell." Mr Taverner (*Hansard*, 1/12/97, page 45) said "the terms he would accept were as follows: 'factory,' 'dairy,' 'milled,' and 'pastry.'" On the 14th December, 1897, this Bill was passed by the Assembly without a division and promptly rejected by the Legislative Council. In 1898 a modification of the original bill was reintroduced but was unfortunately so clipped and trimmed when passed into law, that it left the Department in a worse position in regard to control than before, because it forced us to place the brand of a "Crown" under the words "Approved for Export" and over the word "Victoria" on all butter other than pastry. Prior to the passing of the "Exported Products Act 1898," all butter for export had been classed into three different grades, the soundest and best butters being stamped "Sanctioned by the Department of Agriculture, Colony of Victoria," with a "crown" in the centre surmounted by the letters "V.R." The class between good butter and pastry was not stamped, while pastry butter was branded with the word "pastry." Outsiders and those in the trade abroad naturally conclude that if an article bears the Government stamp it is an indication of quality, but now when a person finds two extremes of quality under one official brand, he shrugs his shoulders and says "There's Government inspection for you—this is what happens when the Government interferes with private business." An attempt was made in 1901 to get a measure passed to patch up the defects known to exist, but this was also summarily thrown out by the Upper House. There is not the slightest doubt but that had the measures required by the Department of Agriculture been passed, the transposing of brands, and some of the other practices revealed by the Commission would have been impossible.

Appointment of an Expert in London.

Mr. Taverner's first act after his appointment as General Agent to represent the State of Victoria in Britain in selecting a man with an intimate knowledge of the perishable export trade in the State must be commended. With a purely clerical or non-expert assistant,

probably more voluminous, but perhaps misleading and harmful reports would be sent out regarding our products. A general report in vague and indefinite terms on the quality of butters arriving in London, as supplied in the past, is of no use here, and unless the author of the report be an expert, it is more than likely he will at times be made the unconscious tool of people having a special axe to grind. I anticipate that more favourable reports will be forthcoming in future to enable greater headway to be made this coming season.

Instruction in Cheesemaking.

During the year Mr. Archer gave instruction in the manufacture of cheese at 29 cheese factories, and the several letters received in appreciation of his services bear eloquent testimony to the efficient manner in which his duties were performed. However, it was recognised that the work of dairy supervision and instruction was being impaired through the diversion of Mr. Archer's efforts to the cheesemaking branch, and Mr. McMillan was appointed as cheese instructor. There is a great field for improvement in the quality of Victorian cheese. A large interstate and African trade requires catering for, but the relative prices of butter and cheese on the London market will have to undergo a considerable change before it will pay to divert milk from buttermaking to cheese. It would appear that these far away markets can be more economically catered for by dairying countries within short distances, such as Canada, America, and Holland. Therefore, when freight is such an important consideration, it is better to send the more concentrated product, butter.

Ripening at Low Temperature.

The cool storage of cheese was taken advantage of during the past season with gratifying results, and in this connection it might be mentioned that Mr. J. Sawers, of the Edendale Factory, the most successful cheesemaker in New Zealand, has been maturing his cheese at temperatures down in the forties. At the principal shows held in New Zealand for years past Mr. Sawers was the most successful exhibitor, and is generally looked up to as the king of cheesemakers there.

Pork.

The export of pork and pig products is still on the increase, and doubtless would have by this time reached large proportions had not the swine plague retarded the operations of breeders and given a complete set-back to what promised to be a rapidly increasing trade. Interstate business consists chiefly of cured products, bacon, ham, etc., whilst South African business is composed of frozen pork. With a surplus production the outlet for pork appears to be practically unlimited, and as a profitable adjunct to dairying there yet remains great room for its expansion.

Poultry and Eggs.

Mr. Hart, in his report, deals exhaustively with the poultry and egg branch of the export trade, and here we have perhaps the most startling illustration of the utility of Government supervision and grading for export. It is pointed out that when, a couple of years back, all the work of preparing poultry for export was done at the Government Cool Stores and the Government stamp placed thereon, the trade rapidly developed. Through the cutting of prices this part of the business went outside for a time, enabling exporters to pack stuff which would not be passed by the Department's officers as worthy of the Government stamp, resulting in the diminution of the trade to vanishing point, and the absolute sacrifices of orders from abroad. All the exporters have returned to the Department again, to secure the advantage of its independent supervision and stamping, with the result that business connections are being renewed.

Veal.

A quantity of veal was shipped, and the demand is such as to warrant the belief that when the country is again stocked this trade can be so built up as to assume important dimensions. With increased competition in the world's markets for dairy produce, it is reassuring to know that these by-products of the dairy, pork, poultry, eggs and veal yet remain to be developed, and promise a ready, profitable return.

Mutton, Lamb and Beef.

Owing to the good season for grass, there was such a demand from the northern districts, and especially from New South Wales, for re-stocking purposes, that the price of cattle and sheep remained so abnormally high as to preclude exportation, but the condition of the few sent in for export at the commencement of the season left nothing to be desired. It is a peculiar fact that in the past good season there was practically nothing offering for export, whilst during the preceding season of drought 500,000 carcases were shipped. This appears at the first blush unintelligible, but the shortage of food in the season before last induced stockowners to rid themselves of surplus stock, in order that sufficient grass might be left to carry the remainder safely through. High percentages of lamb marking are reported from all over the State this season, and inquiries already made indicate a good campaign in the coming spring.

Rabbits and Hares.

With "bunny" a check in value from 20 to 25 per cent. has been experienced, the much vaunted unlimited British market being sorely taxed by the wonderful fecundity of the rabbit. For the season, 2,414,816 pairs of rabbits were exported from Victoria, as against 4,063,417 pairs for the year before, but New South Wales and Tasmania having come into the business a large increase in the total

sent to London is the result. Prices have therefore dropped and profits have become so reduced that according to latest reports New Zealand is threatening to relinquish the business altogether. It is satisfactory to record that not a solitary complaint has been received for the year regarding the quality and get-up of Victorian rabbits, all of which have been graded and packed under Government supervision. This makes the third consecutive year that Government graded and stamped rabbits have given universal satisfaction. The grading of nearly 5,000,000 rabbits requires over 6,000,000 separate inspections when "reject" rabbits are counted. This work is completely and satisfactorily controlled by the Department and furnishes a valuable lesson to those who think that the Department cannot properly grade butter for export. The grading of butter would mean but a fractional part of the work entailed in connection with rabbits.

Government Cool Stores.

The business of the Government Cool Stores shows a loss, owing to the scarcity of produce offered for export during the season, particularly mutton and lamb. Only 38,000 carcases were sent in, as compared with over 180,000 for the season before. The demand for restocking purposes was accountable for the shrinkage. Rabbits also show a falling off of 430,000 pairs, as compared with the year before, in consequence of lower ruling prices; the increased labour required for last harvest diverted trappers' efforts into the more remunerative channel. Poultry also dropped from 75,000 to 31,000 head, in consequence of the decimation of stock through the drought. Butter, although showing a four-fold increase on the previous year, totalled only 9,000 tons, much of the aggregate for the season having been treated at outside cool stores at reduced rates.

Export Trade in Perishable Products.

The perishable export trade as a whole shows a slight falling off, from £2,041,275 to £1,881,684. Dairy products increased, but the reduction in meat, rabbits and fruit is accountable for the aggregate discrepancy. The prospects for the coming season are reported as most promising.

Details of Work.

During the year, 18,609 separate boxes of butter were examined, 13 exhibits of Show butters were judged, 53 samples of milk and 26 creams tested mainly for the purpose of settling differences between dairymen and factory managers, 3,792 letters written, and 1,966 reports sent out to various factories.

Dairy Supervisors' Reports.

Mr. Archer reports:—During the past year I have inspected 33 butter factories, 29 cheese factories, and 9 creameries, and imparted instruction to the managers. Some of these have been visited several

times, having assisted with plans and advice the successful inauguration of some new co-operative factories, also in rectifying faults in manufacture and management, and have always been well received by both managers and directors who have frequently sought my counsel. I have visited 99 farms and given information *re* feeding and general management, particularly of milk and cream, but owing to the want of a proper system of dairy inspection good results have been nothing like so pronounced as would have been the case had we a proper system of dairy inspection. However, when I have been able to explain the object and provisions of the proposed bill drafted by the Department of Agriculture, they have been universally approved of, all admitting the necessity of a proper system of dairy inspection, and expressing confidence in the officers of the Department. It was conceded that little good will be derived from leaving it under the control of the municipalities, owing to local influences preventing the inspector from executing his duties in a fearless and straightforward manner. I have visited six agricultural shows for the purpose of testing milk in connection with the dairy cow competitions (an account of some of which have been published in the Journal of the Department), and also for giving information to farmers. I have attended seven centres in connection with the farmers' classes, inaugurated by the Director of Agriculture, giving as many as six lectures at one centre, on breeding and management of stock and dairy, instructing them in the use of the Babcock tester for culling out the unprofitable cows. I have found the students take great interest in this branch, and feel sure that the result will be of great value to the farmers themselves and the State as a whole.

Mr. Carroll reports:—For the year ending June 30th I visited and inspected 141 dairy farms, 40 factories and 15 creameries, attended at four country shows to supervise milking cow tests and conduct testing. I regret to say that I am unable to record any progress in dairy inspection since my last report; a number of shires have abandoned dairy inspection entirely, not because they think it unnecessary and valueless, but chiefly on account of its patchy application. In the shires still continuing the system of inspection there is a noticeable slackening of the efforts of those charged with carrying it out, due no doubt to the absence of a compulsory and universal system of inspection. It is painful for me to again refer to the uncleanly state of some dairy farms, and to find on my second and third visits the advice given on previous occasions utterly disregarded. I feel certain that a system of inspection, combined with instruction, would confer a boon on the dairying industry of Victoria, and when properly understood would be welcomed and appreciated by the majority of dairy farmers. In my visits to the dairy farms I was able to give a good deal of advice in regard to the culling and breeding of dairy stock, conservation of fodder, and the proper care of the milk and cream. The greater part of the export season was taken up in attending to instruction in butter factories, and I am pleased to state that I was thus enabled to do a considerable amount of practical good. Factories experiencing any difficulty with the

quality of their output immediately wrote to the Department for assistance, but not before the fact was on record at the Cool Stores, when, under instructions from Mr. Crowe, I visited many of these factories to investigate and rectify faults. Owing to the number of calls coming at practically the one time, it was impossible to attend to all of them, but the most urgent cases were visited and assisted. Several factories were visited two and three times, and at a few even as long as three weeks were spent before the difficulty was removed. I was invited to attend meetings of dairymen, to place before them the advantage of co-operative dairying, and to give advice in the inauguration of new companies. Some of the newly formed companies are slow to take advantage of the lessons of the past in the way of providing sound and permanent buildings. The erection of cheap structures from unsuitable material is a false step, and will place the producers of the locality where they may be constructed at a disadvantage as compared with others whose produce is treated in better equipped and more up-to-date factories. I also attended directors' meetings for the purpose of discussing the necessity of rebuilding and making additions to building and plant.

REPORT ON DAIRYING IN NEW ZEALAND.

By R. Crowe.

The instructions received on the 16th May from the Director to inquire into the system of dairying in New Zealand implied that that colony was gaining ground as compared with Victoria, that the Government grading and stamping of butter prior to export had assisted progress there, and that on account of the disclosures before the Butter Inquiry Commission legislation would be asked for and therefore all the information possible should be secured at once and be ready first hand when needed.

The number of inquiries pouring in daily since my return prompts me to prepare a preliminary summary, as through pressure of work I see no prospect of preparing a thoroughly comprehensive report for some time to come.

My views being so well known I thought it possible that those who have always strenuously opposed the grading of butter for export might say I was biassed before starting. In order therefore to investigate impartially I changed my original programme considerably, and instead of going on to Wellington where possibly I might be recommended to visit select localities I went into the country alone at Auckland and on through to the famous Taranaki district on the West coast of the North Island, where I spent a fortnight visiting dairy farms and butter factories, penetrating nearly to the heart of the wild King country where dairying was carried on. I desired to ascertain the effect of the grading system or as so many here are pleased to term it, Government interference, on even the remotest settlers.

I, posing as an ardent opponent, used all the stock arguments employed here against the practice, condemning it as a gross waste of time, energy, and money, which did no more than provide billets for an army of graders, and urging that if necessary at all, grading should be done at the London end, or at the factory, that the graders were liable to make mistakes, and that butter graded as first quality here would turn out in some cases second quality in London, and *vice versâ*, whilst the Government stamp on the boxes did not help its sale in any way and so on.

I soon realised that I had not come fully prepared as I had omitted to bring a phonographic recorder with me, the poor unfeeling notes I made at the time conveying no idea of the opinions given or the forcible way in which they were expressed. It was also very soon made manifest to me that I should have been accompanied by a thoroughly competent shorthand writer. I had the good fortune to meet Mr. Foreman, President of the National Dairy Association at Waitera, Taranaki. A dairyman of long standing, he was able to

give me a good deal of detailed information regarding grading and the treatment, shipping, and carriage of butter to London.

On reaching Wellington both the Minister for Agriculture, the Hon. Mr. Duncan, the Secretary for Agriculture, Mr. Ritchie, the Acting Dairy Commissioner, Mr. Cuddie, Mr. Harkness, Secretary of the National Dairy Association, and many others connected with the industry gave me the fullest particulars respecting every phase of the industry.

I then went to the South Island and visited many places near Christchurch. At Dunedin I met the secretary of the parent National Dairy Association, South Island, Mr. Scott, who gave me a detailed history of that most useful organisation from its inception, even to copious extracts from the minute books.

After visiting Edendale, where I met Mr. John Sawers, the king of New Zealand cheesemakers, I went out to Wyndham, and was introduced to Mr. Milne, president of the National Dairy Association, South Island, proceeding thence to Invercargill and on to the Bluff. Returning to Timaru I inspected the works recently erected at Pareora, by the South Canterbury Meat Freezing Company, reputed to be the most conveniently arranged and up to date freezing works in New Zealand. I visited nine other freezing works before inspecting these, four of which were more extensive than those at Pareora. Crossing to the North Island I attended the Palmerston North Dairy Show, returned to Wellington and left on the home journey on Saturday, 28th June.

Grading Dairy Produce for Export.

I interviewed hundreds of dairy farmers, visited scores of farms and dozens of butter and cheese factories, and went through five grading stores, seeing the butter and cheese graded and studying the system of instruction employed. The buyers and agents for export butters interviewed were, with three exceptions only, most enthusiastic as to the beneficial effect of grading on the dairying industry. One of the dissentients, the secretary of a butter factory, asserted that "the proper place to grade was at the London end," but this was combated by others, who pointed out to me that such a course was out of the question, as a whole fortnight's butter was landed in a couple of days after the arrival of each boat, and it would not be practicable to defrost and examine the cargo, the delay would seriously interfere with business. At any rate, they said that although the real object of grading was to keep the managers of factories up to the mark, yet the time which would elapse between making the examination in London, and the receipt of the reports here, would render that advice of no value.

The second complaint was from an agent, who stated that "sometimes dairy butter classed by the graders as second was better appreciated than first grade at the other end, and would have sold for more than it did but for the grade stamp. He thought that the

first grade stamp in the dairy class might be confined to the best dairy butter, other dairy butters being unbranded with the grade stamp." He frankly confessed, however, "that the grading of factory and milled butters was all right, and was a great help to the industry and those engaged in the export trade like himself."

The third objector, an importer from England, said that "he did not believe in grading," but I afterwards learned that this man had bought New Zealand butter at the beginning of the season and lost, owing to the lower prices ruling in London. No doubt he would have been glad to have had a chance of repudiating his contract, but with the grading and branding of the butter such a thing was impossible.

Although a great number of dairymen, butter factory managers, secretaries and directors were either much averse to the innovation at first, or looked upon it with a great deal of misgiving and doubt, now there is not one to be found who does not admit the pronounced success of the grading system. The following are typical replies given to my queries on the question of grading:—

Dairymen state:—

"We would be nowhere but for our grading system." "The best thing that ever happened for our dairy industry."

Managers usually answer:—

"I know that if anyone else is higher I never rest till I get up to him." "My word it keeps us up to the tick all right."

Directors say:—

"No difficulty in selling butter now with our grading system." "The grading system is acknowledged by banks and buyers in London, and advances are made, according to grade, on bills of lading with grade certificates attached." "The great advantage we find is in selling; it prevents disputes, and there is never any question as to quality or standard, the Government graders' verdict and stamp being final and binding." "If the grading system were dropped to-morrow, the quality would drop also."

Agents and buyers say:—

"Why, we simply base all our bargains on it; we could not do without grading now. It acts on the managers just the same as giving marks to boys at school."

Another told me he bought "thousands, aye tens of thousands of boxes of butter on the Government grade; that some days his purchases exceeded 11,000 boxes, and that he never looked at the butter himself." All he wanted to see was the Government certificate to the effect that the butter was of first grade quality and was stamped accordingly.

Experts assert:—

"They all like it now; it used not to be so; people were frightened at first, but they quickly recognised the advantages once it got started."

The Produce Exchange in England has recently embodied in its rules that the Government grade certificate shall be accepted by them as final in regard to quality; and another, that Government certificates of weights shall be binding. Such an acknowledgment, coming as it does from perhaps the most conservative element of the trade, should be convincing.

These are features of grading that were never bargained for when the system was introduced. It was originally brought into existence for the sole purpose of educating factory managers, preventing the continuance of defects in quality, keeping directors informed in reference to the standard of their output, and, in short, encouraging the production of good and discouraging the making of bad butter. All the other advantages that have since accrued in the way of facilitating trade were not dreamt of at the time the method was initiated.

Grading prevents the introduction of any practice that tends to lower the quality of the output whether at the factory or on the farm. When a bad report is received it carries great weight as it is a serious thing for the manager to have the second grade stamp placed on the boxes, and he is directly called to account by his directors. He in turn very soon brings the careless supplier up to the mark. Home separators are unknown in New Zealand as we know them. I came across only one of these machines and it was used by a supplier to a butter factory only when supplies, in winter, were insufficient to keep the factory going. There are a few in the country but only in remote localities where the dairymen are situated very long distances from one another, and they are employed as stepping stones towards the creamery system. As soon as the local supply is sufficient to run a creamery or a butter factory economically, one is started and all the milk skimmed there.

That the grading system is not perfect is freely and generally admitted. Occasionally a butter scoring a high number of points is reported as not bringing as good a price or not turning out as well as another, but such instances are very exceptional. The principle is so sound, and the results are so satisfactory that the system is to be extended with a view of securing even better results. It has been suggested by the two National Dairy Associations I have referred to that two members of the grading staff should be sent to England each year to make, as far as possible, a general examination of shipments on arrival and inquire into all specific complaints and report in terms that will be understood by the staff at the New Zealand end. It is conceded by the experts grading the butter that greater weight is possibly given to specific defects than is warranted from a London point of view, and that perhaps certain other faults are not quite sufficiently discounted. The reports received from non-experts at the other end are usually not intelligible and it is thought that many of the terms used are too vaguely and generally applied. Frequently a butter is called "fishy" when it is really only "tallowy," and "stale" or off flavor in some other way instead. The proposal to supply this

want and send graders to London alternately, I was given to understand, was being favorably considered by the Department of Agriculture, and will probably be carried into effect this coming season. There is a staff of eight graders, and three instructors who sometimes act as graders, all under the control of a Dairy Commissioner. The graders also act as instructors in the slack season of the year. There is also a clerical staff of four in the Commissioner's and graders' offices, making a total of sixteen officers in the dairying division of the Agricultural Department. Six grading ports for butter and cheese, and one for cheese alone are registered.

On asking what would be the best means of converting unbelievers in Australia to a system of grading I was told that "If the evidence I had collected were insufficient to convince even the most sceptical, anyone open to conviction should be sent over there and he would see and learn for himself, but the hard-headed men who would not condescend to be persuaded might be left alone, it was no use troubling about them." On mentioning that in Victoria vested interests were so strong that a certain section of those connected with the industry regarded a grading system such as this with apprehension as likely to enable many other buyers to compete with them on a better footing. I was told that "that was just what would benefit the producers, the more buyers who bid for their butter, the better were the prices likely to be. That at any rate was the result in their case."

Winter Fodder for Stock.

Perhaps the most surprising feature in connection with dairying in New Zealand is the condition of the stock, for although it was midwinter every beast I saw was in what might be termed a meaty condition, indicating that at no period of its growth or life did it encounter any shortage of food or starvation, as with us in Victoria. The animals here are hardy looking, with more of the frame showing, but their cows in full profit were almost fit for the butcher, and I was told that they come into profit in the springtime almost fat. This is due to the summer's heat not drying up the pasture, as it does with us, and to the enormous growth of fodders provided for the winter time. In some districts in the North Island, near timbered or bushy country, the cows are in winter turned into the scrub, where they find abundant herbage and shelter; and those who have not bush country grow immense areas of turnips, mangels and carrots, the cattle being turned into these turnip fields, which are subdivided with temporary fences. Every farmer grows turnips, the small farmer having his five-acre plot and the large farmer his 100-acre paddock. The turnips are grown in rows about 26 inches apart, with plants nine inches from one another. The Mammoth and Champion Swede are the most extensively grown varieties, whilst the Lincoln Red, Globe, Devon and Greystone are grown for earlier use, and the Waites, Eclipse, Greentop, Yellow Aberdeen and the Romney Marsh are all represented. Some few farmers still sow broadcast, but all the broadcast sown crops that I saw were failures as compared

with those sown in drills. Some enormous yields are secured, for instance, Messrs. Watson Bros. produced 51 tons 11 cwt. of Swedes from an acre of ground near Invercargill, in competition for a prize given by the Winton Agricultural Society, and Mr. John Thompson, of the same neighbourhood, produced 51 tons 4 cwt. to the acre, whilst other competitors obtained 42 tons, 41 tons, 37 tons, and 36 tons respectively. Mr. Thomas Miller in the five acre class of common turnips grew an average of 43 tons 15 cwt. to the acre, other competitors averaging 33 tons, 32 tons, 31 tons, and 28 tons respectively. In the class for best 10 acres, Mr. A. Dawson grew an average crop of 47 tons whilst other exhibitors grew 43 tons and 33 tons respectively. An average good crop ranges from 25 to 30 tons per acre. Altogether 392,830 acres of turnips are grown, 8,141 acres of mangels, 1,833 acres of carrots, 376 acres of beet, and 119,856 acres of rape, making a total of 523,036 acres of winter food for stock. At an average estimate of say 20 tons to the acre it will be seen that New Zealanders grow about 10,000,000 tons of fodder per annum to carry their stock through the winter. But New Zealand has in addition twelve million acres of cultivated grass as compared with nearly one million acres in Victoria. From Auckland to Wellington is about the same distance as from Sydney to Melbourne, and from Wellington to the Bluff is about as far as from Melbourne to Adelaide. Therefore the country to be traversed in a straight line in New Zealand is as far as an overland journey from Sydney to Adelaide *viâ* Melbourne and through almost the whole of this country pastures are met with on a par with those in the Colac and Camperdown districts, only that there are more stock to be seen everywhere. It is a grand sight to see so many head of stock and all in the pink of condition. Notwithstanding these advantages I was somewhat disappointed to learn that the average yield of dairy cows was not greater. According to Mr. Cuddie, the Acting Dairy Commissioner for New Zealand, it amounts to 130 lbs. of butter fat per head as against Victoria's average of about 120 lbs., or only one-twelfth less. Considering the dryness and shortness of our seasons compared with those of New Zealand this speaks well both for our dairymen and their cows.

Butter Factories.

The butter factories visited by me were altogether different in type to any of those we have in Victoria, in that practically all the operations of separating, cream cooling, cream maturing, churning, working, printing and packing, are carried out in the one room, and the only departments outside this one large workroom being the offices, engine and boiler room. The milk is usually hoisted, but in somewhat different fashion to our methods, on to a platform, where it is weighed, going by gravitation through the different processes into the cream vats located on a raised platform high enough to run the cream into the churns. The rooms are well lit, ventilated, and provided with cement floor, the standard of cleanliness being about on a par with that met with in Victoria, but they have no factories so

well built and equipped as a half a dozen of our very best. Their buildings and plant, too, are on a much less expensive scale, for owing to the difference in temperature they need not be as careful as we are in insulating and refrigeration. The refrigerating machines are all from a half to one-third less powerful than in Victorian factories with a similar output. I should say, therefore, that with their arrangements, close supervision of the work would be more practicable than with ours. Of course it would not be practicable to adopt the same system here on account of our warmer summer and longer spells of unfavourable weather.

Shipment of Butter.

The butter is sent to one or other of the various grading ports where freezing works are located for cooling prior to shipment. Auckland, New Plymouth, Patea, Wellington, Lyttelton and Dunedin are recognised grading ports for both butter and cheese, whilst the Bluff is a grading port for cheese only. All the freezing is done for the factories by private enterprise, excepting at New Plymouth and Patea, where the works are co-operative. The charges for freezing each box are 7d. at four of the ports, 8¾d. at Auckland, and 9d. at Lyttelton. The cost of freezing is subsidized by the Government to the extent of the charge in excess of 3½d. a box, which is borne by the factories. This subsidy amounted to £15,105 for the season just closed for freezing alone. The factories have, through the two National Dairy Associations of the North and South Islands, made a contract with the New Zealand and Shaw, Savill and Albion shipping companies for the carriage of their butter and cheese to London at the rate of ¾d. per lb. for butter and $\frac{9}{16}$d. per lb. for cheese, with a rebate of 2½ per cent. for the first three years and 5 per cent. for the last two years, the contract having two years more to run. In addition to these rebates, which are allowed to the factories through the Association, the shipping companies collect the butter from the various grading ports and deliver it to the ocean steamers at Lyttelton and Wellington free of charge. This in itself is a large concession, and in some instances would approximate to 10s. per ton. The companies not only carry the butter for less money than our companies but also give a warranty in their bill of lading in the following terms:—

5. It is warranted that the refrigerating machinery and chambers were in perfect order at the time when shipment commenced and equal to the work required of them, that the vessel carried competent engineers for working the machinery, that the chief of such engineers holds a Chief Engineer's Certificate and is under the control of a Captain, that he shall be instructed to keep a correct register of the temperatures in the chambers daily, and duly enter same in log book kept for the purpose, which shall at all times be open for inspection by the shippers, consignees, and underwriters or their representatives; that such log book shall be initialled by the commander of the ship, that the temperature as far as possible not to be allowed to exceed 25 degrees Fahr. in the warmest part of the chamber, that coal sufficient for a protracted voyage shall be carried by the vessel; that on all arrivals at port of discharge the representative of the underwriters be accorded free access to the chambers and afforded every reasonable opportunity for inspecting the dairy produce previous to and during the discharge.

The agreement also provides—

10. In the event of any reduction in freight on dairy produce, or better allowance, terms, or conditions being made by the shipping companies in connection therewith, or by any other *bona fide* shipping company during the currency of this agreement, a similar reduction or allowance shall be made to the Dairy Association, provided they accept all the essential conditions on which the alteration in rate is based; or this contract may be cancelled in the event of the shipping companies refusing to allow the lower freights or better conditions offered to the Dairy Association.

The Dairy Industry Act of New Zealand enables the branding, handling and freezing and shipment of dairy produce to be properly and fully controlled.

Dairy Shows.

Each year two dairy shows are held, one in the South and the other in the North Island. The South Island exhibition is noted for its fine display of cheese, the exhibits reaching a very high standard of excellence. Most of the cheese factories are located in the South Island, whilst at the dairy show held in the North Island, exhibits of butter predominate. These dairy shows are much more useful than anything of the kind in Australia, in that the exhibition is held in the centre of a dairying district and at a time of year when dairymen, factory directors and managers, as well as buyers and agents can attend. The best and latest dairy machinery is exhibited in motion in a comprehensive form under one roof so that one has not to travel all over the ground in order to find the exhibits. I was pleased to see dairy machinery of Victorian manufacture much in evidence, especially Cherry and Sons butter-workers, churns and utensils, and Humble and Sons' refrigerators. Upon one of the latter machines stood the Hon. G. Y. Duncan, the Minister for Agriculture, when formally opening the show. Some of the exhibits were original and an improvement on anything of the kind introduced previously, particularly the stands for the half-ton churns which were made of cast iron, the stopping gear being like a coarse cog wheel keyed on the shaft so that the churn could be locked at any angle. This had the effect of throwing all the concussion on the floor instead of, as in most of our factories, causing the building to take up the vibration. Some fine skimmed milk automatic measuring appliances, butter printers, milk-weighing scales, cream atemporators, and an improved Babcock milk testing machine, cream elevators and cheese presses were displayed.

There were 117 exhibits of butter and cheese, there being 44 exhibits of 2 boxes each in the principal class for butter. The butter was placed in the cool store six weeks before the show and was subjected to the treatment it would receive in its carriage to London previous to judging. Although the general quality was very good, the butters being well made, extremes in flavor were very marked, one sample especially being quite fishy.

A noteworthy feature in connection with this show was that on the second morning of the exhibition factory managers were given an

opportunity to test the various exhibits and make comparisons for themselves. The judges attended to explain the differences and indicate the faults both in butter and in cheese, the unsuccessful competitors thus gaining more information than even their successful rivals, discussion being full and free. The verdict of the judges was universally accepted. Unlike here the Government experts do the whole of the judging at these shows, and the instructional value of this public demonstration is very great. In addition to dairy machinery and products, fruit, home industries, seeds, farm root products, vegetables, poultry and school's competitions were all represented. These shows were really started by the National Dairy Associations in conjunction with a centrally located Agricultural and Pastoral Society, and under the auspices of the Department of Agriculture. I would strongly recommend the holding of a similar show in Victoria, by the Royal Agricultural Society for preference.

Manufacture of Dried Milk.

During the currency of the show the firm holding the New Zealand and Australian rights for the manufacture of dried milk ran a crowded special train from Palmerston North to their factory at Makino, some 17 miles out, where this product was manufactured. Messrs. Nathan and Co. have gone to considerable expense in installing machinery, as extensive boiler power and a great deal of fuel are required. The machine itself consists of a very strong cast iron frame with parallel rollers resting on bearings, the drums being about one-eighth of an inch apart. Steam is connected through the shaft, which is hollow, by means of a pipe and ordinary packing glands, the outlet being through the other axle, which is similarly mounted. The cylinders are 5 feet long and 28 inches in diameter, and have a perfectly smooth surface; 40 lbs. of steam were indicated, and the rollers revolved inversely 7½ times per minute by means of a mechanical attachment. The milk was fed with perforated pipes about one foot above the rollers and dropped on them in a straight shower. All the moisture in the milk evaporated and was carried away through a large pipe leading from a cowl over the apparatus. Less than one revolution brought the roller in contact with the knives, which were fitted by set screws, so as to shave the surface without touching the metal too hard. From these knives fell away continuous sheets of dried milk resembling cream-coloured crimped tissue paper. On falling into a box this paper-like substance broke to pieces, being afterwards scooped into a primitive wooden drum fitted with beaters, which broke it down to very fine powder. This product, which is sterile, may be turned into new milk again by the addition of seven parts of hot water. The new reconstituted milk tastes just like pasteurised milk, cream rises to the top, and it behaves in an exactly similar manner to ordinary milk. In fact some of it had been put through a separator, the cream ripened, and butter made from it in the usual way. Very little is known as yet as to the practical utility or commercial value of dried milk, although numerous experiments are being conducted in various

parts of the world, particularly in New York, where it was first manufactured. However, although there appear to be immense possibilities in store for it, it is as yet premature to jump at conclusions regarding the extent of its utility. The Messrs. Nathan and Co. are sending me quantities sufficient to test here in any way deemed fit, and promise that Victoria will be one of the first places where it may be manufactured, as soon as its value is conclusively ascertained, probably within a very few months.

It is impossible to embody in a short summary such as this the vast fund of information I have gleaned regarding freezing works and their management. In this connection I may mention that there are in New Zealand 12 extensive freezing and preserving works, some employing up to 400 hands each, an account of which I shall submit as soon as time permits.

RAINFALL IN VICTORIA.

MONTHS OF JUNE AND JULY, 1904.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in June, 1904.	Average rainfall for each Area for the month of June based on all previous years of record.	Maximum fall recorded within each Area during June, 1904.	Actual Average rainfall recorded in each Area in July, 1904.	Average rainfall for each Area for the month of July, based on all previous years of record.	Maximum fall recorded within each Area during July, 1904.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	1·27	1·71	1·53 at Rainbow	1·70	1·25	2·48 at Mildura
B	1·55	2·43	2·20 ,, Goroke	2·41	2.01	3·17 ,, Apsley
C	2·49	3·44	3·30 ,, Panmure	2·93	3·12	3·64 ,, Terang
D	2·99	4·31	3·71 ,, Rivernook	3·80	4·00	4·81 ,, Rivernook
E	1·21	1·98	1·74 ,, Charlton	2·02	1·34	2·68 ,, Charlton
F	1·96	2·83	3·44 ,, Eldorado	3·54	2·19	4·71 ,, Chiltern
F1	2·45	3·23	3·28 ,, Seymour	3.87	2·54	4·82 ,, Euroa
F2	4·10	4·97	5·47 ,, Yack'nd'ndah	6·89	4·04	8·03 ,, Yackandandah
G	3·22	2·93	4·82 ,, Allendale	3·56	2·19	4·76 ,, Kyneton
H	4·33	3·77	4·99 ,, Daylesford	4·37	3·02	4·56 ,, Daylesford
I	2·38	2·62	3·29 ,, Melbourne	1·73	2·36	2·45 ,, Ballan
I1	4·15	3·53	5·66 ,, Dandenong	3·11	3·48	3·53 ,, Dandenong
K	4·58	5·72	8·30 ,, Warburton	4·65	4·40	8·73 ,, Bright
L	1·89	3·37	3·82 ,, Traralgon	1·56	2·62	2.21 ,, Bruthen
M	—	4·54	2·96 ,, Gabo	—	3·61	3·67 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

EXPORTS FOR SEASONS 1903-1904 AND 1902-1903 RESPECTIVELY.

Description of Produce.		Quantities.		Values.	
		1903-4.	1902-3.	1903-4.	1902-3.
				£	£
Butter	lbs.	33,009,812	19,183,399	1,444,167	1,278,059
Milk and Cream	cases	12,002	15,192	15,027	28,486
Cheese	lbs.	932,770	1,537,694	23,320	32,035
Eggs	doz.	23,519	59,328	588	2,966
Poultry	head	47,132	124,500	5,892	15,868
Pork	carcases	2,264	710	3,374	946
Ham and Bacon	lbs.	1,172,280	3,284,427	43,960	123,166
Veal	carcases	5,143	8,296	10,286	15,429
Mutton and Lamb ..	,,	181,170	353,440	108,702	172,117
Beef	quarters	7,972	3,432	15,944	12,864
Rabbits and Hares ..	pairs	2,414,816	3,748,356	120,740	253,962
Fruit	cases	88,850	318,896	45,646	79,724
Fruit Pulp	lbs.	7,272,000	2,052,301	90,900	25,653
Totals		..	..	£1,928,546	£2,041,275

SUMMARY.

	Value 1902-3.	Value 1903-4.
Dairy Produce	£1,496,955	£1,546,614
Rabbits and Hares	253,962	120,740
Meat	184,981	124,646
Fruit	105,377	136,546
Totals	£2,041,275	£1,928,546

EXPORTS DURING JUNE AND JULY, 1904 AND 1903.

Description of Produce.		June. 1904.	June. 1903.	July. 1904.	July. 1903.
Butter..	lbs.	606,660	780,660	605,168	814,344
Cheese	lbs.	86,280	93,960	87,840	54,960
Milk and Cream	cases	836	412	1,091	230
Ham and Bacon	lbs.	11,120	75,600	153,600	45,800
Poultry	head	3,810	21,735	1,650	4,545
Eggs	dozen	5,076	1,760	7,586	..
Mutton and Lamb ..	carcases	7,326	9,205	3,251	10,801
Beef	quarters	370	268	252	377
Veal	carcases	916	167	522	121
Pork	,,	538	90	158	360
Rabbits and Hares ..	pairs	328,012	317,208	729,480	557,364
Fruit	cases	925	9,472	4,597	6,124
Fruit Pulp	,,	156	238	426	634

DELIVERIES FROM GOVERNMENT COOL STORES FOR SEASONS 1903-1904 AND 1902-1903 RESPECTIVELY.

Description of Produce.		Quantities.		Values.	
		1903-4.	1902-3.	1903-4.	1902-3.
				£	£
Butter	lbs.	20,642,272	5,017,600	911,845	246,086
Butter ex bond	,,	8,400	..	368	..
Milk and Cream	cases	8,644	10,534	10,733	13,167
Cheese	lbs.	43,065	..	718	..
Eggs	dozen	31,248	85,563	2,136	4,278
Poultry	head	27,973	75,096	3,497	10,594
Pork	carcases	1,241	117	2,068	234
Veal	,,	1,071	2,367	2,140	4,734
Mutton and Lamb	,,	37,845	181,894	26,492	127,325
Beef	quarters	1,381	720	2,762	1,440
Sundries	lbs.	117,665	60,634	2,941	758
Rabbits and Hares ..	pairs	1,559,597	1,989,860	77,979	125,127
Fruit	cases	10,791	14,379	5,395	7,189
Fruit Pulp	,,	3,630	378	2,677	283
Totals		..	..	£1,051,751	£541,215

Summary.

	Value 1902-3.	Value 1903-4.
Dairy Produce	£279,093	£933,505
Meat	129,523	32,195
Rabbits and Hares	125,127	77,979
Fruit, &c.	7,472	8,072
Totals	£541,215	£1,051,751

DELIVERIES FROM THE GOVERNMENT COOL STORES, DURING JUNE AND JULY, 1904 AND 1903.

Description of Produce.		June. 1904.	June. 1903.	July. 1904.	July. 1903.
Butter..	lbs.	240,072	276,360	138,880	439,600
Butter ex bond	,,	—	—	—	8,400
Milk and Cream	cases	801	916	956	1,002
Cheese	lbs.	10,174	—	13,898	—
Eggs	dozen	16,062	24,876	13,062	9,849
Poultry	head	415	3,012	664	45
Rabbits and Hares ..	pairs	233,744	324,064	321,960	263,994
Mutton and Lamb ..	carcases	4,977	1,088	1,037	2,572
Beef	quarters	63	192	80	241
Veal	carcases	128	108	37	53
Pork	,,	529	66	84	388
Fruit	cases	—	230	—	—
Sundries	lbs.	15,972	8,017	12,880	9,729

R. CROWE.

ARRIVALS IN MELBOURNE OF BUTTER and Butter ex Cream in Tons net, from the different districts of the State for the last 13 months, as compared with the previous corresponding months.

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
July ..	563½	435½	108	54½	16½	17	179	190	260	174
August ..	641	468	163	99	33	24	122	122	323	223
September ..	1288	1042	323½	216	87½	63	317	267	560	496
October	2122	1607	439	360	174	92	697	567	812	788
November ..	2750	2049	622	430	201	94	943	787	984	738
December ..	2756	1995	528	358	194	83	1026	860	1008	694
	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.
January	2220	1985	403	362	150	66	917	870½	750	686½
February ..	2047	1383½	407	90½	170	51½	844	814	626	427½
March	2033	1371	316	112	156	27	938	740¾	623	491½
April	1167	910½	156	140	77	14½	580	443	354	313
May	930	794	119	137	29	14	466	354	316	289
June	596	595½	106½	118	29	13½	239	213	222	251
July	527½	563½	111	108	53	16½	134½	179	229	260

R. CROWE.

Fruit and Plants.

EXPORTS to Australian States and New Zealand, Inspected during June and July, 1904.

Fruit.	Cases or Packages Inspected.		Certificates Given.	
	June.	July.	June.	July.
Apples	359	37	18	11
Bananas	270	315	71	78
Grapes	3	—	1	—
Lemons	554	515	51	57
Melons	11	11	4	1
Mixed Fruits	—	2	—	2
Oranges	507	659	57	82
Passion Fruit	15	32	14	17
Pears	124	51	11	5
Persimmons	3	—	2	—
Pineapples	143	169	41	51
Quinces	10	—	1	—
Tomatoes	—	3	—	3
Bulbs	—	1	—	1
Plants	25	27	15	17
Totals	2,024	1,822	286	325

IMPORTS and EXPORTS Inspected for twelve months ended June 30, 1904.

—		Imports.			Exports.		
		Australasian.	Extra Australasian.	Total.	Australasian.	Extra Australasian.	Total.
Apples	cases	38,801	10	38,811	14,759	49,421	64,180
Apricots	,,	...	...	...	5,336	...	5,336
Bananas	,,	667	...	667	14,938	...	14,938
Black Currants ..	,,	1,462	...	1,462	1	...	1
Custard Apples ..	,,	80	...	80	...	...	...
Cucumbers ..	,,	8,214	...	8,214	614	...	614
Figs	,,	...	...	...	49	...	49
Gooseberries ..	,,	...	...	...	1,135	...	1,135
Granadillas ..	,,	3	...	3	...	...	...
Grapes	,,	77	6	83	4,510	15	4,525
Lemons	,,	15,312	16,716	32,028	7,370	...	7,370
Loquats	,,	2,161	...	2,161	57	...	57
Mangoes	,,	9	...	9	...	...	...
Melons	,,	2,656	...	2,656	115	...	115
Mixed fruit ..	,,	213	88	301	31	...	31
Nectarines ..	,,	527	...	527	284	...	284
Onions	,,	...	100	100	...	...	...
Oranges	,,	340,047	5,114	345,161	7,011	20	7,031
Passion fruit ..	,,	12,667	...	12,667	473	...	473
Peaches	,,	723	27	750	4,016	...	4,016
Peanuts	,,	...	114	114	...	...	...
Pears	,,	68	67	135	22,988	2,003	24,991
Persimmons ..	,,	527	...	527	24	...	24
Pineapples ..	,,	52,693	...	52,693	2,607	...	2,607
Plums	,,	106	67	173	3,293	...	3,293
Potatoes	,,	8	...	8	...	...	...
Quinces	,,	...	...	...	328	...	328
Shaddocks ..	,,	7	...	7	...	...	...
Strawberries ..	,,	2,020	...	2,020	...	...	...
Tomatoes ..	,,	8,448	...	8,448	1,069	...	1,069
Veg. Marrows ..	,,	28	...	28	...	...	...
Bananas	bunches	653,639	...	653,639	...	...	...
Blackberries ..	casks	325	...	325	...	...	...
Black currants ..	,,	36	...	36	...	...	...
Cherries	,,	15	...	15	...	...	...
Raspberries ..	,,	353	...	353	8	...	8
Bulbs	cases	6	39	45	7	...	7
Plants	,,	591	195	786	583	...	583
Barley	sacks	192	1,963	2,155	...	...	...
Beans	,,	...	805	805	...	...	...
Maize	,,	100	800	900	...	...	...
Oats	,,	112,150	...	112,150	...	...	...
Peas	,,	2,178	29,574	31,752	...	...	...
Rice	,,	...	136,568	136,568	...	...	...
Wheat	,,	90,656	411,973	502,629	...	...	...
Totals ..	..	1,347,765	604,226	1,951,991	98,746	51,459	150,205

Figures relating to imports inspected also represent total imports. As to the exports, the figures do not represent the total trade, but only those consignments inspected. (All Extra-Australasian consignments, however, must be passed by inspectors before shipment.)

FRUIT, GRAIN and PLANTS Inspected for Import and Export for year ending June 30, 1904.

—	Imports.			Exports.	
	Packages Passed.	Packages Condemned.	Certificates Issued.	Packages Passed.	Certificates Issued.
Fruit	559,975	64,895	3,516	149,615	12,825
Grain	786,959	...	90	...	...
Plants	786	...	209	583	274
Bulbs	45	...	24	7	5
Totals	1,347,765	64,895	3,839	150,250	13,104

FRUIT EXPORTED beyond the Australian Commonwealth and New Zealand during Season 1904.

Destination.	Apples.	Pears.	Grapes.	Oranges.	Total
	cases	cases	cases	cases	cases
United Kingdom	41,605	1,961	15	...	43,581
South Africa	440	...	...	...	440
Germany	3,364	15	...	..	3,379
Java	717	19	...	...	736
India	1,693	4	...	...	1,697
Italy	500	...	...	...	500
Malay Peninsula	330	...	...	...	330
Belgium	400	...	...	20	420
British Columbia	172	4	...	...	176
Mauritius	200	...	...	...	200
Totals	49,421	2,003	15	20	51,459

FRUIT EXPORTED beyond the Australian Commonwealth and New Zealand for Seasons 1901 to 1904 inclusive.

Destination.	1901.	1902.	1903.	1904.
	cases	cases	cases	cases
United Kingdom	27,361	36,797	61,287	43,581
South Africa	6,067	4,524	15,250	440
Germany	...	...	5,250	3,379
Java	...	...	3,394	736
India	2,502	1,657	2,153	1,697
Italy	...	...	25	500
Malay Peninsula	20	200	450	330
Belgium	...	...	182	420
British Columbia	...	...	...	176
Mauritius	...	...	...	200
China	100	50	2	...
U.S. America	...	100	...	...
Totals	36,050	43,328	87,993	51,459

J. G. TURNER, Inspector,
For C. French.

Frozen Meats, &c.

PRODUCE INSPECTED AND EXPORTED beyond the limits of the Commonwealth during the years ending 30th June, 1903 and 1904 respectively.

Kind of Produce.		1902-3.	1903-4.
Lamb	carcases	106,199	98,317
Mutton	,,	219,451	65,640
,, ...	pieces	813	8
,, ...	legs	7,114	16,772 legs, 129 pkgs.
Mutton hams	cases	22	159 hams, 5 cases
Beef	carcases	1,143	860
Veal	,,	6,834	5,746
Pork	,,	820½	1,458½
,, ...	pieces	29	3
Beef	,,	1,669	4,241
Calves' feet	..	1,050 feet, 25 pkgs.	179 cases
,, heads	..	280 heads, 74 pkgs.	541 cases
Ox tongues	..	531 tongues, 30 pkgs.	299 tongues, 299 pkgs.
,, tails	..	236 tails, 27 pkgs.	127 tails, 463 pkgs.
,, kidneys	cases	59	—
Sheep kidneys	..	2,647 kidneys	5,900 kidneys, 1,582 pkgs.
,, tongues	..	3,240 tongues, 1 tierce, 97 pkgs.	1,344 tongues, 2,511 pkgs.
,, trotters	cases	56	17,000 trotters, 395 cases
,, frys	no.	6,622	55 cases
Sweetbreads	,,	616	93
Brains	..	650 sets, 6 pkgs.	7 cases
Sausages	..	388 lbs., 78 pkgs.	1,975 lbs.
Meat extract	cases	23	—
Mutton suet	,,	10	—
Dripping . ..	lbs.	234,794	5,801 lbs., 483 cases
Bacon and ham.. ..	..	16 sides	29
Margarine	casks	1	—
Corned beef	kegs	183	300 lbs., 235 cases
,, pork	,,	3	33
Beef & mutton sundries ..	cases	295	10
Fish	,,	79	242
Rabbits—Frozen ..	no.	8,087,538	5,747,269
Hares ,, ..	,,	2 977	—
Poultry ,, ..	,,	116,157	—
Rabbits—Canned ..	lb.	1,195,008	—
Meat ,, ..	,,	3,365,424	—
Hares ,, ..	cases	1	—
Poultry ,, ..	,,	184	2,546
Fruit ,, ..	,,	50	55
Vegetables ,, ..	,,	36	—
Tomato sauce	,,	15	—
Jam	lbs.	23,040	—
Calves' livers	..	—	1,200 livers, 70 cases
,, tongues ..	..	—	16 pkgs.
Tripe	cases	—	77
Fruit pulp	,,	—	448
Tallow	oasks	—	315
Sheeps' heads	..	—	6,200
Cow heels	..	—	5 pkgs.
Minced veal	..	—	150 lbs.
Black & white pudding ..	..	—	30 pkgs.
Ox cheek	cases	—	12

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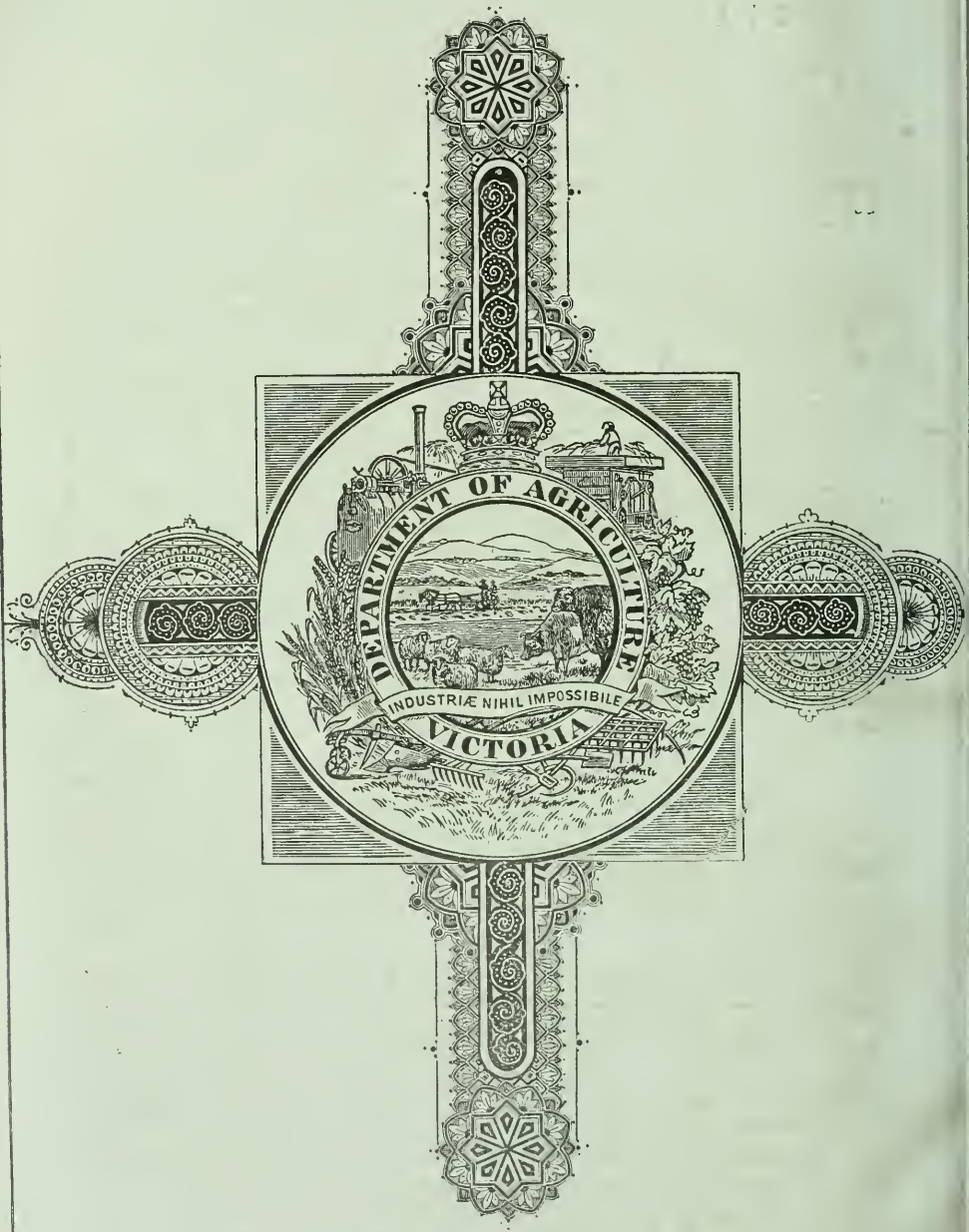
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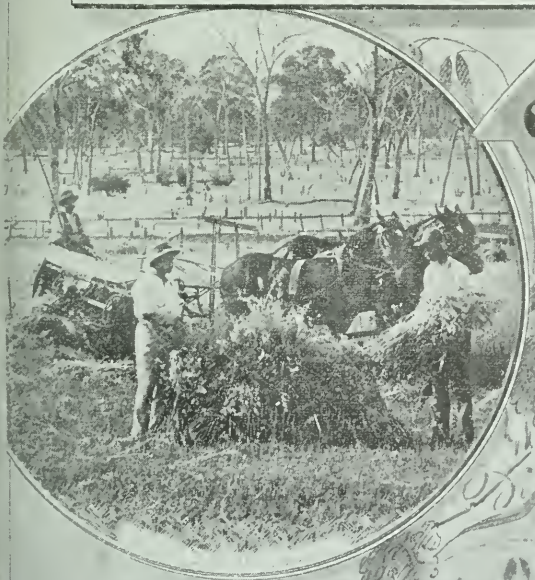

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AGRICULTURAL JOURNAL OF VICTORIA.

NOVEMBER, 1904.

THE POSITION OF CHEMISTRY AS A FACTOR IN AGRICULTURAL ADVANCEMENT.*

By F. J. Howell, Ph. D.

The inter-relation of effort in the various departments of human activity is scarcely realised. Busied as we are in our own particular sphere, there is hardly a recognition that the practices of our own special industry are being continually re-acted upon and altered, not so much by activities within that sphere, as by the application of discoveries made by others engaged without that sphere, and busied in an apparently entirely foreign set of operations. Among all occupations, there is perhaps none which so much bears the apparent character of being self sustained, and which wears such a seeming complete isolation from interference with all outside thought and discovery, as the occupation of farming. And yet, the farm practices of to-day have been, perhaps, moulded to a greater extent by outside influence and investigation, than by the individual efforts of generations of farmers themselves. The chemist, the physicist, the botanist, the metallurgist and the mechanician, has each contributed some new fact, that has helped to lift farming from a matter of dibbling in seeds with a pointed stick to the position it holds to-day. The object of my paper is not to show the debt which agriculture owes generally to outside activities, but to disclose to you the relations which one science, among many, holds to the calling you pursue.

Fresh from the farm, with its conditions and practices so strikingly dissimilar, the scenes of an agricultural chemical laboratory would, I feel sure, prove very singular to you. The sight of a number of analysts busily engaged in a set of operations with tubes, flasks, retorts and apparatus generally of an apparently mysterious nature, would, I fear, raise doubts in many of you as to the possibility of all this having any connection with the advancement of agriculture. In what way, you might ask, can a set of such operations, carried out in a dingy town building, influence in the least the life, the welfare, the line of present action, or the future conduct of either myself or the class I belong to? Such a question is one which might naturally suggest itself to nine out of ten among you; and yet, those tubes, and flasks, and retorts, are the working tools of a science which has done more to revolutionise the whole system of agricultural practice than all other agencies combined. A science which has still, even to-day perhaps, a more intimate bearing on the success of your present and

* A paper prepared for the Farmers' Convention at Kyneton, June, 1904.

the prosperity of your future than any other science. It will be of interest and value to trace the growth and influence of a branch of human inquiry which has so profoundly affected the calling you follow.

The establishment of agricultural chemistry as a separate department of science dates from the commencement of last century only. One hundred years is a short span, measured even by the length of our civilization; and yet nearly the whole of that great mass of facts, which we include in the term agricultural chemistry, is the result of the labors of the great investigators who lived from the commencement of last century down to our own period. A review of the discoveries of that period will, perhaps, afford the farmer a clearer picture of what science has done, and may do for him, than the history of the accomplishments of any other separate department of inquiry. To learn and understand the links of connection between only one department of science and the actual practice of farm life, will help in the realisation, by you, of one great fact which might modify your whole mental attitude towards the subject generally. The fact I refer to is, that no rational system of agriculture is anywhere possible without the application of truly scientific principles.

To draw comparisons between the condition of agricultural chemistry at the present day, and its condition at the commencement of last century, there must be clear ideas of the functions of this branch of science. To the great Englishman, Davey, belongs the credit of first establishing agricultural chemistry as a separate department of science; and although the earlier investigations of his predecessors helped him and the later inquiries of his successors considerably overshadowed his work, we can all, I think, feel proud of the share he took in establishing the fact of the intimate relations existing between chemistry and agriculture. In a comparison of his teachings with the knowledge of to-day, will be revealed the great gulf which separates our position, in this respect, from that of his time.

You will recognise that chemistry, as related to agriculture, has its well defined activities in laboratory, field, stall and factory; and in each of these spheres investigation during the last hundred years has revealed such an accumulation of facts, as to lift our agriculture of to-day into a calling founded on truly scientific principles, as opposed to the empiricism of the earlier period. The first task which would naturally suggest itself to chemistry, in its relation to agriculture, would be the investigation of the soil, its composition and changes; and even at the commencement of the nineteenth century some little progress had been made in this direction. But chemistry at that time had all its great unsolved problems before it. It required to take up the study of the plant; to investigate the principles of nutrition, both by field experiment and laboratory test, and to establish the relations of the soil to the plant. It required to carry out a similar line of inquiry with regard to the live stock of the farm; to determine the principles of animal nutrition and establish a system of feeding on a scientific basis. The new facts, gained by these investigations, suggested new

lines of expansion and new provinces of activity. They led to a systematic analysis of all vegetable and animal products; and the acquired knowledge of crop characteristics following this, with the added knowledge of the relations of soils and crops, opened up the great possibilities in the modification of crops, in specific directions, leading to the elimination of undesirable and the strengthening of desirable qualities. From the purely investigational, chemistry passed then to the regulative or protective, in which the products of the farm, and the products sold to the farmer were subjected to analytical control. It inquired into the purity of foods, stock foods, manures and agricultural products generally, with the view, on one side, of preventing fraud being practised on the farmer in his direct purchases; and on the other, with the object of preventing an indirect injury, by excluding sophisticated articles from competition with the genuine produced by himself, both on foreign and local markets.

Side by side with this protective work and investigational activity in laboratory, field and stall, the chemist directed his attention also to the processes of the factory; and by new developments in chemical technology, opened up new and unexpected avenues for the profitable utilization of a wider range of products from the farm. By the solution and explanation of the various processes underlying the preparation of certain products, and suggestions in economy of working, large and important industries were assured an extended existence, and the by-products of manufacture utilized with profit. Wine making, tanning, brewing, the manufacture of glucose and starch, sugar and fertilizers, are instances in which chemistry has, either directly or indirectly, profoundly influenced the activity of a whole district and sometimes of a whole country. The wonderful conquests of this science will be more fully realised, when we reflect that the whole of the work and discoveries, just enumerated, are the result of the labors of a little more than 100 years.

The general review of what has been accomplished will give some idea of the prominent part chemistry has played in agricultural development; but the true magnitude of its influence can only be brought out by a consideration, in detail, of a few of the industries which have grown up and amplified under its discoveries.

The Fertilizer Industry.

The discussion of the fertilizer industry is one which, perhaps more than any other, might interest you. The use of artificial fertilizers in Victoria is sufficiently recent to attach a general interest to the matter. The industry is one which owes its origin and continued existence entirely to chemical discovery. At the commencement of the nineteenth century, little was understood of either the composition or the functions of a manure; and even late in the first half of the century, opinion appeared general that the organic matter of plant life was derived solely from the decaying vegetable matter of the soil, and not in the main from the atmosphere and water. Generations of farming experience had shown the value of certain refuse of barn

and stable in the growth of crops. The benefits of lime, gypsum, marl and ashes, were known; but the value and functions of potash and phosphoric acid were not appreciated, and the great question of the use of mineral manures had not yet been brought forward. The renovating effect of certain leguminous crops was recognised, but the reasons were unknown. It was Liebig's systematic study of the mineral manures, and his discovery of the action of a mineral acid upon a phosphate in effecting greater availability, which laid the foundations of the great fertilizer industry which has since grown up. The immense potash deposits of Germany, and the nitrate beds of Chili, have, since then, disgorged their millions of tons of material for use in agriculture. Numberless phosphatic deposits have been exploited in all parts of the world, and have been prepared in the factory in amazing quantities, in an available, concentrated, and easily transportable form. The by-products of iron foundries, gas works, and oil cake factories, containing valuable fertilizing manurial ingredients, have been placed on the market, and have helped to swell the long list of valuable materials now at the disposal of the farmer for the increase of his crops. This great industry, with its multitudinous ramifications, had its beginnings in the investigations of a few patient laboratory inquirers, who knew probably little or nothing of the actual tillage of the soil. As an example of what the industry has grown to, the following figures are highly suggestive.

In 1860, there were produced in the United Kingdom, 200,000 tons only of phosphatic fertilizers; while at the present, some 300,000 tons of mineral phosphates and about one-third this quantity of bones are required for the production of the 800,000 tons of superphosphates etc., which may be regarded as the average annual output of this class of manure. In America, the enormous growth of the industry, in recent years, is still more striking. The value of the total output of artificial fertilizers of the factories in 1859 amounted to only £178,268. In the year 1879 it reached a value of £4,730,159; while in 1889 the value of the manufactured product was put down at approximately £8,000,000. The Chilian production of nitrates in 1902 exceeded 1,400,000 tons, and the quantity of potassic salts produced in Germany the year previously reached three and a half million tons.

The Glucose, Starch, and Distilling Industries.

The manufacture of glucose, starch, and the products of distilling industries, afford other striking examples of the new avenues for the utilisation of agricultural crops, which might be opened up by chemical discovery. Maize, perhaps, is the most important crop grown in the United States, and it partly owes this position, not to its use as a raw product only, but to the various manufactured products derived from it. The average production for the ten years ending December, 1897, was according to Wiley, 1,844,951,786 bushels. Out of this quantity, probably over 100,000,000 bushels

were used alone in the manufacture of the two first products given above. Practically, the whole of the starch produced in America is derived from the grains of maize, which contain up to 65 per cent. of this material. The amount of maize required in the starch industry is said to even exceed that used in the manufacture of glucose, although the glucose industry in the States is one of immense proportions. Used in the liquid form for table syrups, confectionery purposes, and admixture with molasses and honey; and in the solid form as a substitute for malt in brewing, this product, required for its manufacture in the year 1897 as much as 40,000,000 bushels of grain. The manufacture of whisky, all commercial alcohols, and alcoholic products, also requires very large quantities of maize, as nearly the whole of these products used in the United States are derived from this source. Underlying the manufacture of all these materials are chemical processes, and the industries may be regarded as resting principally on chemical foundations. Chemistry, however, has gone further than the consideration of the primary product of manufacture, and has looked into the nature of the various by-products, and discovered in the residues from the manufacture of the three materials, just dealt with, a source of cattle feed of the highest feeding value. It has also discovered in the pith of the plant qualities which have opened up the possibilities of new uses; it having recently been found suitable for the manufacture of gun cotton, high explosives, and pyroxilin varnishes, besides proving of use, owing to its resilience and porosity, in battleships.

The Production of Beet Sugar.

The most striking instance, however, of the marvellous industrial developments which may result as the outcome of chemical investigation and advice, is the beet sugar industry. The history of the little plant, taken to Bohemia by the barbarians after the fall of the Roman Empire, reads almost like a romance. Its content of sugar had been guessed at some time earlier; but it was only in 1747 that Margaff, a Prussian chemist, determined the percentage and extracted the saccharine matter. Some considerable time after, the researches of Margaff were continued by a second chemist, Archard, who attempted to apply practically the somewhat theoretical laboratory discoveries of his predecessor; but the first extraction of the factory amounted to 2 per cent. only. From this period on, by careful selection based on chemical control, the plant of a little more than 100 years ago, analysing its 5 per cent. of sugar only, has been so improved that its sugar content may be now put down at 16 per cent., while the factory extraction, through improved processes, has almost reached perfection. Nowhere, in the whole domain of agriculture, has chemistry achieved such a brilliant success, and laid the farmer open to such a debt of gratitude as in this particular industry. It was little thought, 150 years ago, that the quiet researches of an almost unknown chemist would result in the establishment of this great enterprise, which has already revolutionised the agriculture of the greater part of the Old World, and promises to effect a similar change in that of the

New. The formidable proportions at present reached by the industry are clearly brought out by the following statistics:—

The world's total output of beet sugar for the year 1901-2 reached the enormous figures of 6,873,000 tons, of an approximate value of £120,000,000.

In 1901-2 there were 332 factories working in France, nearly 400 in Germany, and over 200 in Austria; while in America the number in operation at the present time probably exceeds 60. The total production of refined sugar in Germany alone, for the season 1900-1, amounted to 1,292,167 tons, and in France, for the year later, 1,051,130 tons. For the French production there were 9,350,852 tons of sliced beet required, grown on an area of 772,100 acres. In Germany, at a period even prior to this, the amount of land under cultivation with beet roots for sugar purposes exceeded one million acres. It is in America, however, that the industry has found the most startling developments in recent times. Commencing with one factory only, not many years ago, there are at present probably over 60 magnificently equipped works in existence; and the dream of the American sugar chemist appears to lie in the direction of making the States entirely independent of outside supplies. In order to accomplish this, it would appear, from an exceedingly interesting paper in the Year Book of the United States Department of Agriculture for 1902, that 500 factories, of a daily capacity of 500 tons of beets, would be required. For the equipment of these factories, an investment capital of £50,000,000, and a working capital of £27,000,000 would be necessary. The annual requirement of beets has been figured out at nearly 19,000,000 tons. For the labor in the factories there would be an annual expenditure of £3,800,000; while the yearly sum paid to farmers for the beets would amount to nearly £17,000,000. The idea can by no means be regarded as of a chimerical nature, and doubtless, in a decade or two, the chances of its realization will be more apparent than they appear to-day. Even in 1901, the factories in existence represented an investment capital of £6,000,000, the beets purchased for the year amounted to 1,875,000 tons, and the money paid to farmers reached £1,687,500. The history of these brilliant developments from such simple beginnings reads, as I have already told you, almost like a romance. The great magician at the back of it all has been the chemist.

The Position of Chemistry as an aid to Agriculture Confirmed.

I have confronted you, I think, now, with sufficient facts to establish the powerful influence exerted on agriculture by chemical investigation and discovery. The review of the history and development of agricultural chemistry has also been sufficiently complete, to indicate the position of this department of science in its whole relations to agriculture. This review will facilitate a proper conception, on your part, of the functions of a State agricultural laboratory, and the duties of its chemist.

The functions of a State agricultural laboratory, in its most complete development, would then be :—

1. Investigational.
2. Protective.
3. Instructional.

The investigational, according to the extent of agricultural development in the particular State, would include research work in laboratory, field and factory.

The activities, which might be grouped under the term protective, might be understood to include a supervisory chemical control of all products linked in any way with agricultural interests, where fraud or sophistication might either directly affect the farmer personally, or the community generally, by unfavorably influencing the future position of produce on the markets of the world.

The instructional would include the imparting of information to farmers, either by lectures or publications, with the view of disseminating a knowledge of results following investigation in both laboratory and field ; and with the object of bringing the whole of agricultural procedure into agreement with the teachings of chemistry generally.

A properly equipped branch of chemistry in a State Department of Agriculture should, to prove effective in all its functions, be provided with the means of carrying out the three sets of duties. To lack the necessary provision in any one of the three, would be regarded as a state of incompleteness. It is, however, not to be forgotten that the particular degree of agricultural development in a country would, in a large measure, determine the nature and decide the scope of inquiry on the part of a chemist for agriculture. In an agricultural community, devoted principally to the production of raw material, to the raising of sheep and cattle, wool and wheat, etc., there would be fewer problems for the chemist, and less demand for his advice than where the many finished products of manufacture, following an advanced state of agriculture, held a more prominent place.

In order to gain clear ideas of the range covered by the different lines of activity, which I have specified as forming the duties of an agricultural chemist, it will be necessary to treat of each in some detail. It is only after the full scope of work, possible in each, has been presented to you, that you will be in a position to judge of what has been done, and what it might be advisable to do, by the chemical branch of your own Department of Agriculture. We can first treat of :—

Laboratory Research Work.

The chemical laboratory research work in a department of agriculture might, under ideal conditions of unlimited funds, and a highly developed condition of agriculture, include an exceedingly wide field of inquiry; since agriculture as related to chemistry has its points of contact in a hundred different directions. The magnificent specialization of work by the bureau of chemistry in America, in which

every conceivable subject, having the slightest connection with agricultural interests, has found its separate study, is an instance of the wide range of inquiry which might be considered to lie within the legitimate province of the agricultural chemist. But such work, it must be remembered, is the work of a highly equipped Federal department of agriculture, in a country, the agricultural and industrial conditions of which are on an immeasurably grander scale than our own. The dietary studies, soil surveys, pure food standards, road material inquiries, and all those larger schemes of investigation included in the work of that bureau, may be considered to lie beyond the powers of a State laboratory of agriculture. In each branch of a State department of agriculture, investigational work, to secure support, must of necessity be confined principally to the immediately applicable. That is, there will be little encouragement for investigation promising a remote and not an immediate value. The demand will be principally for facts of an early and local advantage. The most important laboratory investigational work of a chemical branch of a State department of agriculture may, therefore, be supposed to include :—

1. A systematic examination of soils, with the object of fixing standards of fertility permitting of advice being given on matters of fertilization and special adaptabilities.
2. The systematic analysis of all staple crops and agricultural products of the country, with the object of determining composition and characteristics, and suggesting lines of improvement.
3. Investigations contributing to the establishment of new industries, or the assistance of those already in existence.

Investigational Work in the Field.

The investigational work of the field might, among others less important, embrace the following subjects :—

1. Fertilization tests.
2. Experiments having for their object the alteration and improvement of crops, in specific directions, affecting chemical composition.
3. Experiments to determine the adaptability of soils and districts to certain crops; more especially those, the growth, or preparation of the finished products of which, would involve special chemical investigations and processes.
4. The study of soils generally in connection with the treatment of crops.

Such a comprehensive scheme of field experiments by the chemistry branch of a department of agriculture might, perhaps, bear the appearance of a partial encroachment on the domain of the botanist; but the value of nearly all our agricultural crops is so

largely dependent upon chemical composition, and this, in its turn, is again so largely the resultant of soil characteristics, and cultural and manurial treatment, that all the subjects properly considered might be legitimately included in the province of chemical investigation.

The Protective Functions of Chemistry.

The protective power which might be exercised by chemistry in the interests of the farmer, and agriculture generally, is a very pronounced one. There seems a growing recognition of the value of an extension of State interference in this direction. The prosperity of a country depends principally upon its agriculture. Anything, affecting either the output or the quality of the agricultural products of a country, must seriously affect both the farmer personally, and the community generally. The protective power of the chemist might then, with advantage, be exercised in a rigid system of inspection and chemical analysis of:—

1. All fertilizers on the market.
2. All stock feeds offered for sale.
3. The various insecticides and fungicides in use.
4. Any other material largely used on the farm, or in garden or orchard.

The chemist might also extend his inquiries to an examination of all apparatus used in the butter factories or creameries, with a view of checking and controlling the accuracy of the tests, and guaranteeing legitimate returns to the producers. All such work would partake of the nature of a direct personal protective power, exerted in favor of the farmer. But there are other and larger injuries affecting the farmer, indirectly, which might be wholly prevented by the protective power exercised by chemical supervision. I refer to the prevention of adulterated articles taking the place of legitimate agricultural products on the local markets, as well as to the prevention of inferior or sophisticated produce leaving our shores for foreign markets. The attainment of an undoubted purity and a high standard of quality in all our export produce is an absolute necessity, if we wish to secure an expansion of outside trade. With this object, the protective power of the chemist, exercised in the interests of agriculture might, therefore, embrace a regular and systematic examination of all important exports including:—

1. Dairy products.
2. Preserved meats.
3. Preserved fruits.
4. Jams.
5. Fruit pulps.
6. Honey.
7. Wines.
8. Other agricultural products of importance.

All such products might then leave our shores carrying the chemical guarantee of quality.

The Instructional Duties of Chemistry.

In earlier years, when the teaching of scientific agriculture practically meant the teaching of agricultural chemistry, the chemist took a more active personal part in educational work than at present. His position in this respect, at the present time, will, in any particular State, depend upon the system of the field experimental work prevailing there, as well as on the provision made generally in its Department of Agriculture for instructional duties. Where a system of permanent experiment stations is in existence, and the chemist is one only of many investigators, each with a well defined specialisation in work, there seems no strong reason justifying the facts, resulting from his individual inquiries, meriting a special lecturer or lecturers. But, in the absence of such permanent stations, and under conditions where the whole of his investigations are carried out co-operatively with farmers, there does appear a necessity on the part of the chemist for keeping in close and constant direct touch with the farming community, in order to stimulate and retain the interest necessary to the continuity of the work of the branch. The advisability of providing for travelling lecturers in chemistry under such conditions will not, I think, be questioned, and the subjects dealt with by such lecturers on the platform might include :—

1. Results of field experiments.
2. Manures, their application and methods of valuation.
3. Animal nutrition, with the chemical composition of feeding stuffs, and the approximate comparative money values.

Each of these subjects might naturally be amplified to take in, under many separate lectures, the various aspects presenting themselves.

Work Accomplished by the Victorian Chemical Branch.

I have now attempted to give you a concise account of what may be considered the legitimate functions of a State chemical laboratory for agriculture. There is no pretence of having gone beyond the main essentials of its activities. You will, however, now be in a position to form conclusions as to what should be attempted by the chemical branch of your own Department of Agriculture, and to ask what up to the present has been done.

With respect to laboratory research work of the nature indicated in an earlier part of my paper, little has been attempted until recently—the day to day demands of routine work absorbing the entire time of the analysts. A commencement has been made, however, in co-ordinating the results of soil analysis with field manure tests, with the object of fixing standards of fertility. The investigation of the composition of the staple crops and products of the country still remains largely a work for the future, although much has been accomplished, during the past year, in the comparative analysis of the various forage crops grown experimentally.

With respect to the investigational work in the field, the results already accomplished by this branch may compare with anything of a like nature attempted elsewhere. To enumerate a few of its achievements, it may be stated that the fertiliser tests in Northern soils have been reported on and are well known. The tests in the South, of a more recent date, have resulted in a harvest of facts of equal importance. The beet has been tried for several years over a very wide area, and with results which appear to establish, beyond a doubt, the suitability of Southern Victoria for the growth of the crop. The forage crop tests of last year embraced trials with over 20 crops, either unknown or little grown up to that time in Southern Victoria. Their comparative yields as green fodders have been secured on over 50 different farms, and the returns of grain also obtained from a large number of fields. Nearly every crop has been analysed, and its percentage of dry matter determined. In the hay manuring experiments, the average returns from 50 fields are available for drawing conclusions on the results of a particularly interesting and comprehensive set of tests. The beet experiments, hay manuring tests and forage crop experiments, will each require a separate report.

In the protective sphere of its functions, the branch has been equally active.

An Amending Fertiliser Bill has been prepared for Parliament, making provision for a rigid inspection of manures in warehouse, store and farmstead, and prescribing prosecution, in case of fraud, by the agricultural chemist or his deputy.

A similar bill has been prepared by the chemist, for the inspection and chemical control of all stock feeds. The bill provides that every concentrated feeding stuff shall be sold on an analysis certificate in the same way as a manure, and provides for the Department prosecuting in the case of adulteration. This measure appeared necessary owing to the presence of adulterations, revealed in certain feeds by a large number of analyses made in the laboratory. If investigation should prove that the insecticides and fungicides, so largely used in the orchard, suffer from similar sophistications, the advisability of legislation in this direction will also be considered.

The protective power of the chemist has also been to a certain extent exerted in the examination of our export produce. Analyses have at various times been made of butters and fruit pulps sent in by the responsible officers at the cool stores, and a comprehensive examination of all jams produced in Victoria carried out.

The systematic analysis of the various honeys, preserved fruits and meats, and other important agricultural products is also contemplated.

The Educational Work of the Branch.

The work of instruction by the chemist has found its opportunity for expansion in the short agricultural classes initiated by the Director, and placed under the supervision of the chemical branch.

Out of the fifteen lecturers engaged in this work, five are on the staff of my branch. This however gives no correct idea of the proportion of the work carried out by the branch, as these five lecturers deliver no less than 43 per cent. of all lectures given.

The subjects dealt with by my assistants, include manures and manuring, animal nutrition, theoretical and agricultural chemistry, dairy chemistry and bacteriology; the microscope and its use, with hints on simple methods of micro-chemical analysis on the farm, and a number of other subjects in which chemical considerations may be supposed to enter into the operations of farm practice. The diversion of such a large number of officers to these duties has naturally been at the sacrifice of important work in the laboratory; and the time seems ripe for the creation of a purely instructional division within the chemical branch. The effect produced by these lectures, on the young men attending them, is not to be measured alone by the actual knowledge imparted. They have a much wider influence. The influence they might be expected to exert will, perhaps, be best explained by repeating to you the words of my message to the students at Nhill on the termination of the classes at that centre. I there said:—

"The course you have just gone through, gentlemen, must have been to most of you a revelation of new ideas. It has been valuable in the actual knowledge imparted, and still more valuable, perhaps, in the wide vistas which it must have shown stretch out and beyond the boundaries of the little we have been able to present you. I think the life of the farm from now on may present aspects entirely new to you. You will have learnt the connection, the intimate connection, there is existing between the operations of your field practice and the laboratory of the chemist, the physicist and the botanist. You will, I think, now recognise, more strongly than before, the value of a trained brain as well as a developed muscle; the advantage which a man of well furnished intelligence has over one of an inferior mental equipment. From now on, new desires will, I think, come to some of you; new ambitions, new ideals. The book will, perhaps, take a larger place in your hours of leisure; observation will have been sharpened; and the wish, I feel sure, will force itself more to the front in all of you, to know something of the wonderful workings of the soil you cultivate and the crops you grow. Had the classes done nothing more than produce these changes, they would have done much; but they have done more, for you leave rich with a store of practical facts which must assist you greatly. There is no necessity of my saying more to you, or attempting to give advice ruling the conduct of your lives, but you will allow me, before you disband, to express the hope that the information you have received will better help you to throw into your actions the sustained determination and earnestness of purpose of your parents, the grand old pioneers who have made our home what it is to-day." In this address to students, I don't think I have taken an exaggerated view of the healthy influence which the instruction imparted by the chemical branch, in conjunction with the instruction imparted generally, has exerted on the

lives of your sons who will one day take your places on the farms you have prepared for them.

The Work of the Future.

Before concluding, a few remarks on the future work of the branch might be desirable. It is in every way advisable that provision should be made for an energetic expansion in the three sets of activities I have defined, as constituting the legitimate functions of the chemical branch of a State Department of Agriculture. The important part, which you must now all admit chemistry plays in the whole procedure of agricultural practice, will, I hope, secure from you as a body representing the entire farming community, support for the demands which I have made, and shall continue to make for the advancement of my branch. There must be a recognition on the part of the country that the highly educated young men, who have been trained as analysts and platform agricultural lecturers, are deserving of salaries above £70 and £80 a year. The man who is at present acting, or will one day act, as your expert adviser, is worthy of something more than a remuneration barely sufficient to support life. There should be some guaranty also, both in the interests of the head of the branch as well as in the interests of the officer himself, that a permanency of service might be relied upon. Only under such conditions of service can the requirements of the future be provided for, and a continuity of work in specific directions assured. Under present conditions, the service of nearly all my officers is dependent upon some special vote, liable at any moment to be swept away by any new Government which may attain to power. Such conditions are apt to produce a state of anxiety and unrest among officers who are devoting their lives to a special training in your interests; a training which would for the most part possess no value and find no wide demand outside the Department of Agriculture. The organization of the branch seriously suffers from the temporary nature of the employment of its officers. Such a state checks initiative on the part of the head of the branch, and prevents the putting into action schemes for expansion and advancement, requiring for their performance a certainty of the services of men trained specially for the task. With an assurance of a reasonable remuneration for the services of its officers, and the permanency of their positions, the branch would have no hesitation in undertaking with vigor the full range of its possible activities. It is the laboratory work specially which has suffered from these conditions. The value of the field investigations of the branch has been too prominently brought under the notice of the farmer, to allow this class of work to suffer many setbacks, but the support, which up to this time, has been given by the farmer must in no way slacken. There are numberless problems still demanding solution; and with every new discovery, the field for further inquiry broadens its boundaries. A scheme has been recently placed before the farmers of the country by the chemical branch, which will enable a large variety of field experiments to be conducted over a period of at least

six years on the same farm. It is a step intermediate between the temporary one year test and the permanently established station. The longer period will allow of a greater elaboration and variety in experiment than is possible under the present system of co-operative tests; and with your assistance in placing suitable land at our disposal, and the necessary retention of interest in the work over the required period, there is no doubt that facts of great importance will result. On such an area of ground, the effect of liming, sub-soiling, horse-hoeing, different rates of seeding, different depths of seeding, fallowing, rotative cropping and numerous other tests might be tried. The inclusion of different varieties of wheat, and various summer forage crops, would more especially, if field results were co-ordinated with laboratory investigations by analysis of both soils and crops, afford data in a direction as yet untouched.

Conclusion.

And now I can close my remarks. In the facts I have placed before you concerning the science I represent, there may be much which might be interpreted as partial and egotistical. In speaking of one's own work, it is difficult to avoid the appearance of such features. If, however, I have succeeded in impressing you with the belief that one science only, controls, in a marked degree, the position which the agriculture of a country holds in the world, your whole mental attitude towards science in its application to farming generally might undergo some change; and you might realise, as I wish you to realise, that in the present strenuous competition of life, the possession of a trained intelligence and improved technical methods, is as essential in your calling as it is in the other great spheres of the world's activities.

TOBACCO MANURING EXPERIMENTS.

By F. J. Howell, Ph. D.

General Remarks on the Tobacco Plant.

The ready adaptability of the tobacco plant to a wide range of soil and climatic conditions makes its growth an easy matter, but the extreme sensitiveness of the plant to the slightest variations in these conditions, as manifested in the flavour and quality of the leaf, restricts the possibility of the successful growth of any one type to exceedingly limited areas. It is only a tobacco possessing certain well defined qualities and meeting the specific requirements which, in the present highly specialized condition of the industry, are demanded, that is worth the trouble of growing. As Whitney remarks, "A nondescript tobacco is not worth growing, and should not be grown, as it lowers the price of really good types of tobacco to the detriment alike of the grower and consumer." As there are certain tobaccoes then in demand suited by their particular characteristics for certain specific purposes, and as these characteristics are the resultant mainly of particular soil and climatic conditions, it appears that the two lines of activity to be taken up in investigations connected with the industry are, first, to find out what kinds of leaf are in demand, and then to investigate the existence of the climatic and soil conditions capable of producing the desired characteristics. The second line of enquiry would involve laboratory investigations in the chemical and mechanical analysis of soils, as well as the establishment of numerous and widely distributed observation stations, or, as the term is used here, experimental plots, where tests would be carried out with different varieties.

With respect to the kinds of tobaccoes in demand in different parts, an extract from a recent paper by Milton Whitney will convey an idea of the wide existing differences of opinion prevailing in different parts on the characteristics constituting desirable qualities in the product. "The differences in the export type (known to the trade as 'foreign'), which are cured and manipulated according to the demands of the various foreign countries, are worthy of special consideration. To the general public such differences are sometimes hardly perceptible, but in the trade the slightest difference in shade, color, thickness, shape, or length of leaf, is taken into account in determining to what country or trade the tobacco is best suited. For example, Great Britain gives preference to a long, narrow, olive green leaf, which is required to be heavily fired, in fact the stronger the odor of hard wood smoke, the more acceptable the tobacco is to the British trade. The Austrian Government prefers a long, broad, silky leaf, from medium to light brown colour. The Italian Government uses the same type, only of shorter size and darker in colour, while the French prefer a tobacco that has been made exceedingly dark by means of steaming and hard pressure while hot."

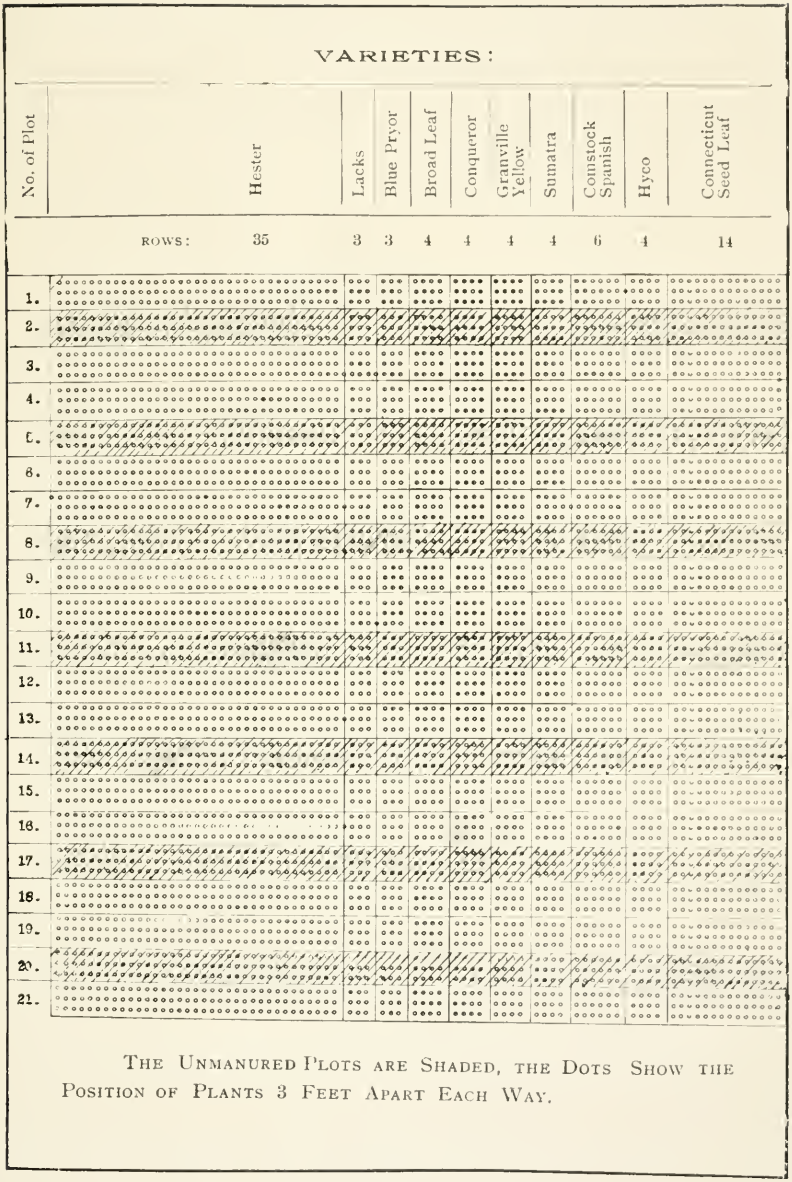
The Commercial Grouping of Tobacco.

The commercial grouping of tobacco is one of classes, types and grades. The adaptability of a tobacco for a particular use, such as cigarette, cigar, or smoking, marks it off as belonging to a class. The possession of certain qualities, as flavour, texture and colour,

determines the type, while the grade expresses the measure of excellence of the leaves from any one type. The production of the different classes and types is the outcome principally of climatic conditions, and the texture and physical properties of the soil. It will be recognised then that the production of the different classes and types cannot be successfully attempted on the same class of soil, that a soil adapted by its physical properties for the production of a large, heavy leaf of a high oil or gum content will not produce a light tobacco. The adaptability of various soils to different classes and types of tobacco has received great attention at the hand of Whitney in America, with the object of determining the conditions favourable to the best development of each type. The ultimate object, as stated, has been "to give a basis for the classification of tobacco soils, and for the improvement and modification of the conditions in many soils, which are not, under present methods of manuring and cultivation, well adapted to any particular type of tobacco."

Prior to similar investigations being taken up in Victoria, the introduction of new and untried varieties is necessary.

The establishment of experimental fields covering a wide range of soils in which various varieties might be tested, would indicate the suitability of particular areas and particular soils for the production of different types. The examination of the soils, on which certain of these types might have succeeded, would then afford data for expressing opinions on the results of analysis as to the adaptability of untried areas for the same type. Until this data resulting from field experiments is available, the chemical and physical analysis of a soil will have a limited value only. Up to very recently, one type only has been almost exclusively grown in the North-Eastern district as the general crop, and the large body of facts resulting from the experience of growers themselves, apart from the investigations of the expert, which affords so much valuable data to the investigator in America, is not available in the case of Victoria. From the experience of growers themselves in America, it has been found that certain varieties, through the yields and excellence of the product, have given a distinct character to certain districts. The work of the expert is to investigate the conditions producing these distinctive characteristics, and, by a comparative study of untried areas, to discover and suggest the possibilities of expansion beyond these restricted localities known by experience to be adapted for the production of these characteristics. In Victoria, in the absence of the growers' initiative, a wide distribution of variety tests must precede any large system of soil investigation. From the variety tests of last year, reported on by Mr. Smith, there is every evidence of the growers of the North-Eastern district being able to produce a tobacco very much superior to the one formerly placed on the market. To obtain some general idea of the character of the soil in the district, a chemical and mechanical analysis of a number of samples taken from different localities was carried out in the laboratory. This examination reveals the presence of the most important plant foods in exceptionally large quantities. The soils may be regarded as of high



THE UNMANURED PLOTS ARE SHADED, THE DOTS SHOW THE POSITION OF PLANTS 3 FEET APART EACH WAY.

PLAN OF TOBACCO EXPERIMENTAL FIELD AT EDI.

fertility. The mechanical analysis discloses a texture indicating no very high retentive power for water, and therefore not adapted for the production of the heaviest types of leaf. The clay content, however, is higher than that of American soils producing the finest types of light yellow tobaccoes. As, however, the type of a tobacco is the resultant of climatic as well as soil conditions, no reliable opinions as to specific adaptability can be formed by comparing the composition of a soil on one side of the world with that on the other; in fact, the determinative influences of climate on the tobacco plant have been shown to be "so subtle as to fail detection by even meteorological instruments." We must find that answer from the plant itself.

The Chemical Composition of the Soil in Relation to the Tobacco Plant.

No plant is so profoundly affected by soil characteristics as tobacco, but it is rather to physical character of soil than to chemical composition that we must ascribe the paramount influence exerted on the physiology of the plant. To quote Whitney again, "It is practically true of tobacco, to a greater extent perhaps than of any other crop, that the texture and physical properties of the soil influence the physiology of the plant to such an extent, as to determine and control the distribution of the widely differing distinct types of tobacco. Soils producing a heavy shipping tobacco will not produce fine tobacco of any variety. Soils, containing a large proportion of clay, or which for other reasons are very retentive of moisture, tend to produce large heavy plants which cure to a dark brown or red. A lighter sandy soil produces a plant having a thinner and more delicate leaf, which, by proper treatment, can be cured to a bright red mahogany or fine yellow colour. So marked is this influence of soil upon the quality of tobacco, that a fine bright tobacco land may be separated by only a few feet from a heavy clay soil which will produce only a heavy manufacturing or export leaf."

Although the paramount influence of the physical composition of a soil is clearly recognised, the chemical composition also cannot escape consideration. A knowledge of this, by revealing deficiency or over abundance in a particular plant food, may suggest means, by fertilization on one side or the reduction of "raging fertility" on the other, of so bringing soils under control as to exercise a decided improvement on the quality of the product. The very great difference in chemical composition of soils, producing different types of tobacco in their greatest excellence, will become apparent on comparing the results of the analysis of two American soils, one a Kentucky, amous for the growth of White Burley, and the other from North Carolina, where it is said the higher grade of yellow tobacco is produced. It will be seen that the first soil, producing the heavy tobacco, is of a high fertility, while the other, on which the highest grade of yellow tobacco has been grown, might be considered very infertile. In fact the poverty of the soil seems a requirement in the attainment of excellence of quality in this class of leaf, and this fact has converted the abandoned soils of North Carolina and Virginia into lands of a high agricultural value. It will be of interest to compare the results

of the chemical analysis of six soils in the Edi district, carried out in this laboratory, with the two American, famous for the production of the two well-known widely different types of leaf.

	Kentucky Soil.	North Carolina Soil
	White Burley Tobacco.	High Grade Yellow Tobacco.
	%	%
Organic and volatile matter ..	8·462	1·2050
Alumina	4·745	2·4965
Oxide of iron	6·240	0·6275
Lime	·836	0·2330
Magnesia	·798	0·0847
Manganese	·146	0·0417
Phosphoric acid	·231	0·0379
Sulphuric acid	·084	0·0140
Potash	·558	0·5045
Soda	·160	0·2892
Silica	78·100	93·5035

Tobacco Soils at Edi.

	Byrne.	Nylon.	Smith.	Howard.	Hall.	Swan Bros.	Average.
	%	%	%	%	%	%	%
Insoluble matter	76·53	54·28	76·41	79·16	83·32	84·12	75·63
Soluble silica	·16	·42	·28	·20	·20	·11	·22
Potash	·49	·58	·56	·36	·34	·39	·45
Soda	·22	·28	·19	·11	·20	·15	·19
Lime	·38	·53	·48	·52	·22	·23	·39
Magnesia	·40	·51	·44	·45	·28	·32	·40
Manganese oxide	·08	·21	·04	·09	·13	·10	·11
Ferric oxide	4·82	15·04	4·86	4·20	3·96	4·00	6·15
Alumina	2·53	7·58	3·78	3·40	2·25	3·25	3·80
Phosphorus pentoxide ..	·34	·48	·32	·35	·18	·17	·30
Sulphur trioxide	·09	·07	·08	·10	·09	·10	·09
Carbon dioxide	·05	·09	·06	·01	·05	·08	·05
Water and organic matter ..	14·09	19·98	12·69	11·16	8·69	7·13	12·29
Nitrogen % in soil	·35	·19	·19	·18	·11	·10	·19
Humus	5·42	5·90	4·27	3·68	2·80	2·25	4·05

A comparison of the average figures of the important plant foods in the six fields with the two American will disclose percentages in the Edi soils practically equalling those of the Kentucky, and considerably surpassing the North Carolina. It is possible that an addition of lime to some of the Edi soils might prove of advantage, but in all other respects the figures would appear to indicate that the use of fertilizers will probably prove of little effect.

Manuring Experiments at Edi.

Field results in manuring appear to have supported the figures of analysis. The results are somewhat irregular, due no doubt to the extremely dry season and soil irregularities, but they tend to indicate that investigations, other than fertilization, might, for the present at any rate, take precedence. The plants were set out as shown on the plan.

The system served the double purpose of giving information as to what varieties might show the greatest adaptability to the particular soil, and the effect of manures generally. In judging the effect of manures, the total weight of all varieties in each plot has been taken,

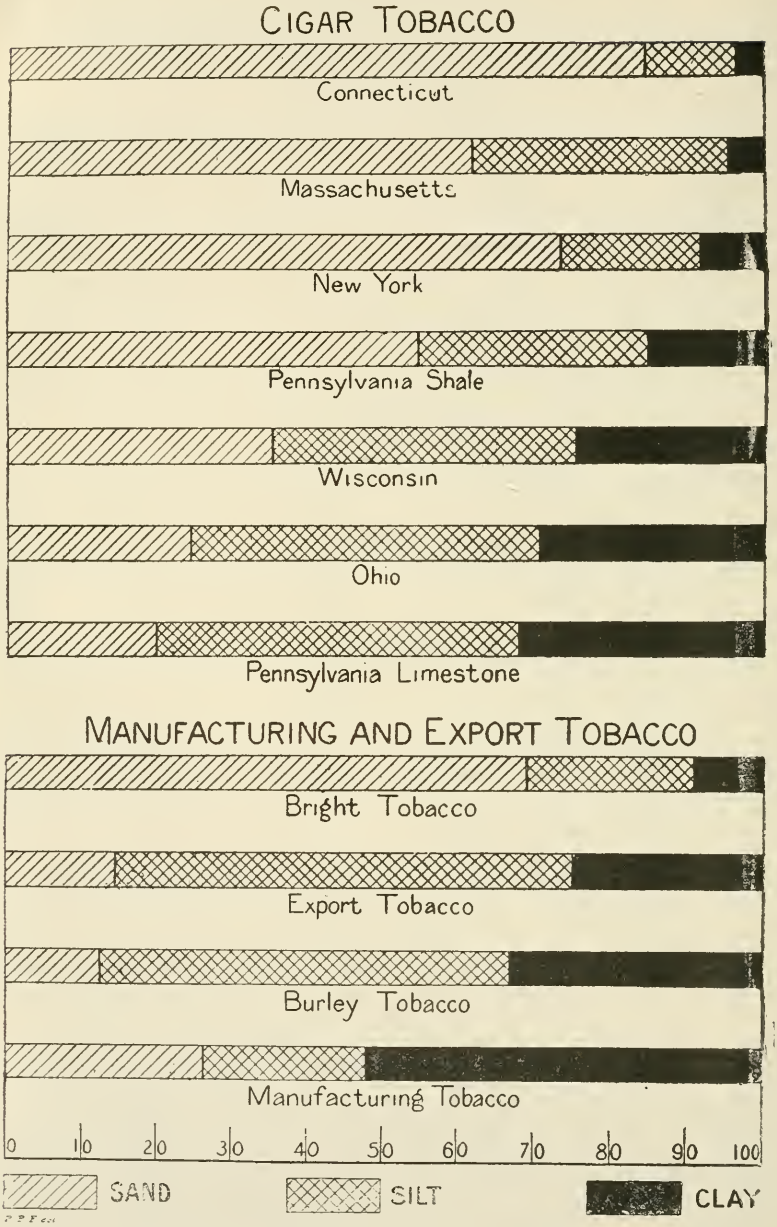
as the area devoted to each variety was too small to give reliable data. The tests were under the supervision of Mr. Temple Smith, and the weights are as handed in by him. The experiments were based on those carried out at the Kentucky Experiment Station. The manures used and the weights obtained were as follow :—

MANURES USED ON TOBACCO PLOTS, WITH AVERAGE RETURNS FROM ALL VARIETIES.

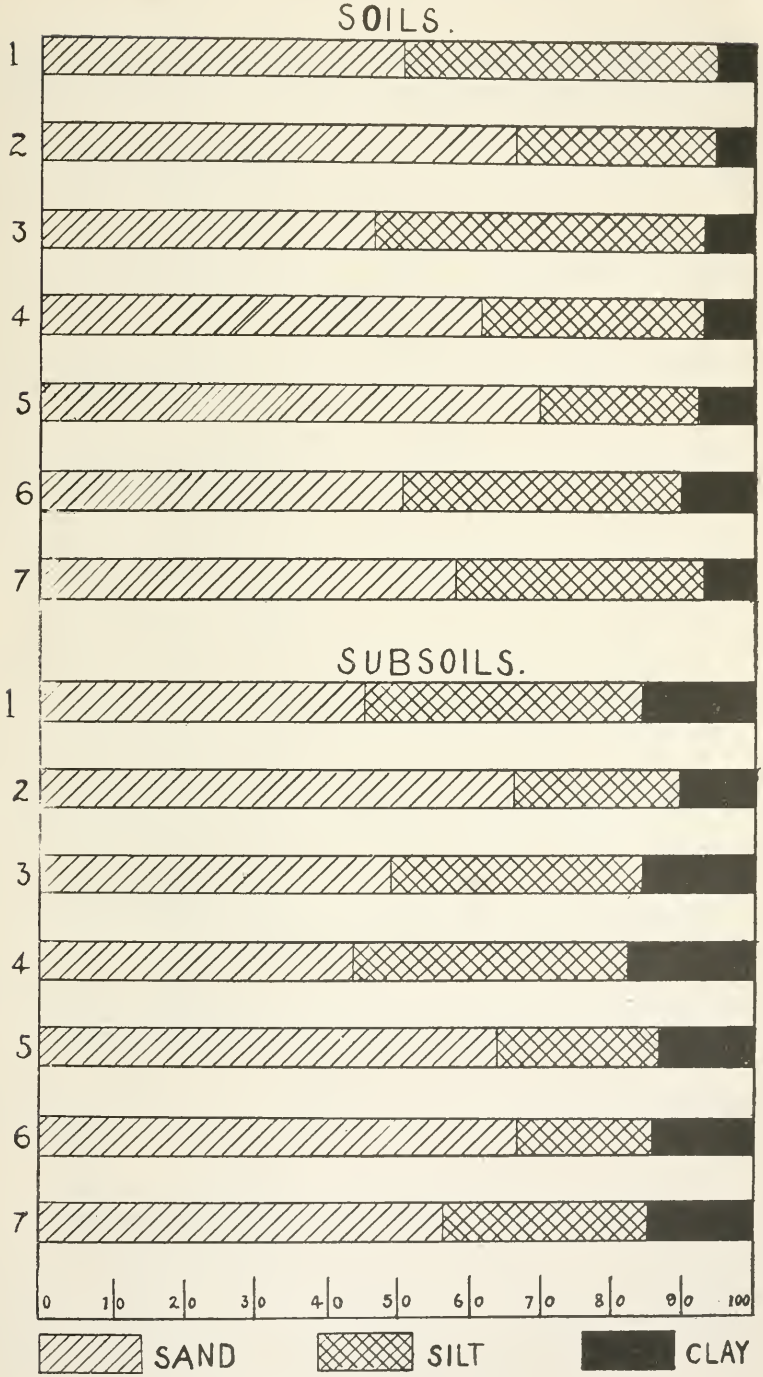
No.		Average Returns per acre from all varieties.
		lbs.
1	160 lbs. nitrate of soda	1,395
2	No manure	1,216
3	160 lbs. potash sulphate	1,210
4	320 lbs. ordinary superphosphate	1,518
5	No manure	1,542
6	160 lbs. nitrate of soda 320 lbs. ordinary superphosphate	1,577
7	160 lbs. potash sulphate 160 lbs. nitrate of soda	1,686
8	No manure	1,620
9	320 lbs. ordinary superphosphate 160 lbs. potash sulphate	1,809
10	320 lbs. ordinary superphosphate 160 lbs. potash sulphate 160 lbs. nitrate of soda	1,653
11	No manure	1,337
12	480 lbs. ordinary superphosphate 160 lbs. potash sulphate 160 lbs. nitrate of soda	1,509
13	560 lbs gypsum	1,477
14	No manure	1,642
15	320 lbs. ordinary superphosphate 160 lbs. potash sulphate 160 lbs. nitrate of soda 560 lbs. gypsum	1,833
16	160 lbs. potash sulphate 160 lbs. sulphate of ammonia 320 lbs ordinary superphosphate	1,769
17	No manure	1,643
18	160 lbs. potash chloride 160 lbs. nitrate of soda 320 lbs. ordinary superphosphate	1,720
19	160 lbs. potash sulphate 320 lbs. nitrate of soda 320 lbs. ordinary superphosphate	1,561
20	No manure	1,511
21	320 lbs. potash sulphate 160 lbs. nitrate of soda 320 lbs. ordinary superphosphate	1,595

THE MECHANICAL ANALYSIS OF EDI TOBACCO SOILS.

As already stated, it is in difference of mechanical rather than chemical composition that we find the most potent influence operating on the physiology of the tobacco plant. The figures giving the results of the mechanical analysis of the six samples, taken from different localities in the Edi district, will give an idea of the general characteristics of the soils of the district in this respect. In addition to figures showing percentages of sand, silt and clay, these percentages have been illustrated diagramatically after the method of Whitney ; and for comparison with American soils Whitney's diagram, showing the percentages of sand, silt and clay in typical American



TYPICAL TOBACCO SOILS OF AMERICA
(Taken from Whitney.)



EDI TOBACCO SOILS.

tobacco soils, has been reproduced. These percentages, however, have to be considered in conjunction with the meteorological conditions prevailing in the various localities. The number opposite each soil in the diagram corresponds with the number in the results of analysis.

RESULTS OF THE MECHANICAL ANALYSIS OF SOME OF THE TOBACCO SOILS AND SUBSOILS OF THE EDI DISTRICT.

Diameter of Soil. (mm.)	Grains.	Conventional Names.	Farms where Samples were taken. Soils. R. C. Hall, Whitfield.	P. Howard, Cheshunt.	— Byrne, Moyhu.	Edi Tobacco Farm.	Swan Bros., Upper King.	Temple Smith, Cheshunt.	Average of 6 soils.	Subsoils. 6 to 30 inches, R. C. Hall, Whitfield.	6 to 24 inches, P. Howard, Cheshunt.	6 to 30 inches, — Byrne, Moyhu.	6 to 24 inches, Edi Tobacco Farm.	6 to 24 inches, Swan Bros., Upper King.	8 to 36 inches, Temple Smith, Cheshunt.	Average of 6 subsoils.
			1	2	3	4	5	6		1	2	3	4	5	6	
			%	%	%	%	%	%	%	%	%	%	%	%	%	%
2	1	Fine gravel	0·43	0·50	0·54	2·18	1·24	0·17	·84	0·43	0·33	0·80	1·78	1·34	1·39	1·01
1	·5	Coarse sand ..	1·64	1·56	1·57	4·72	2·49	0·98	2·16	1·46	1·67	0·92	3·19	2·29	2·84	2·06
·5	·25	Medium sand ..	1·86	1·71	0·62	1·57	2.71	1·29	1·63	1·41	2·29	0·76	1·19	2·81	2·78	1·87
·25	·1	Fine sand	7·12	14·28	4·36	18·56	15·70	6·79	9·47	5·88	13·92	5·27	5·56	16·45	11·24	9·72
·1	·05	Very fine sand ..	34·52	39·88	32·70	38·30	41·88	33·30	36·76	32·69	44·26	40·65	29·04	36·43	43·62	37·78
·05	·01	Silt	33·38	22·50	21·72	17·47	1·39	31·49	21·32	30·42	18·84	23·64	14·97	19·72	12·88	20·08
·01	·005	Fine silt	6·08	1·74	16·79	10·80	19·54	2·10	9·51	5·63	2·88	6·85	20·70	1·38	4·85	7·05
·005	·0001	Clay	4·64	4·68	5·90	6·36	7·17	8·87	6·27	14·84	9·97	14·92	16·75	12·74	13·19	13·74
		Loss @ 110° C ..	3·36	3·48	4·17	2·37	2·01	5·31	3·45	2·32	1·42	2·33	2·72	2·03	2·62	2·24
		Loss on ignition ..	6·76	9·45	11·27	7·35	5·97	9·28	8·35	4·55	4·75	3·64	4·77	4·34	4·76	4·47

The figures above represent what is known as the texture of a soil. A knowledge of the texture of a soil gives a fair, although by no means an absolutely correct, idea of the relative amount of water it will contain. The greater percentage of clay in a soil, the greater amount of water as a rule the soil will hold, and it is owing to these differences in water content particularly, that difference in mechanical composition so profoundly affect the tobacco plant. But the knowledge of the texture alone of a soil is not sufficient to say decisively what the relative amount of water it will contain will be, for this water content is also determined by the structure of the soil, or the arrangement of the soil grains. There are two factors then requiring consideration. The determination of the texture is a laboratory operation presenting no great difficulties. To determine the arrangement of the soil grains is, on the contrary, not an easy task, and the actual relation of the soil to water is best determined by actual moisture tests carried out on the soil itself in the field. Such records of the moisture content of soils in some of the principal tobacco districts of America have been kept continuously for years, and an extension of the system is advocated. As a result of these determinations, the following conclusions have been arrived at. They are given in Whitney's words :—

"Northern Cigar Tobacco Soils.

"Tobacco soils of the best grade in the Connecticut Valley maintain on an average about 7 per cent. of water throughout the season. There are many soils cultivated in tobacco which average 10 or 12 per cent., but these do not produce a tobacco leaf of the finest texture and most desirable quality on the present market. The meadow lands of the Connecticut Valley, which were formerly cultivated in tobacco when a dark heavy leaf was in demand, contain on an average from 20 to 28 per cent. of water. As already stated, these soils are entirely unfit for the production of the grade of tobacco necessary to meet the present market demands.

"The tobacco soils of Pennsylvania are heavier than those of Connecticut Valley, and maintain on an average about 18 per cent. of water.

"The soils of the tobacco district of Ohio are as heavy in texture as the limestone tobacco lands of Pennsylvania. It is probable that the mean water content of these soils in an average season would amount to about 23 to 24 per cent. of water. The tobacco grown under these conditions is used almost exclusively as a filler leaf.

"Soils of Manufacturing and Export Tobacco Districts.

"The typical soils for the highest yellow tobacco of Virginia, North Carolina and East Tennessee maintain on an average about 7 per cent. of water. Where the soils contain less than this, the leaf is inclined to be thinner in texture and to have a better colour, but the yield per acre is small, and the most economical conditions on the whole are maintained by those soils having from 7 to 8 per cent. of

clay and maintaining on an average 7 or 8 per cent. of water. As the soil becomes heavier in texture, and the amount of water increases, other grades and types of tobacco are produced.

"The export tobacco lands of Kentucky and Tennessee contain about 22 or 23 per cent. of clay, and, as a characteristic feature, they contain from 40 to 60 per cent. of silt. These soils contain on an average about 15 per cent. of water.

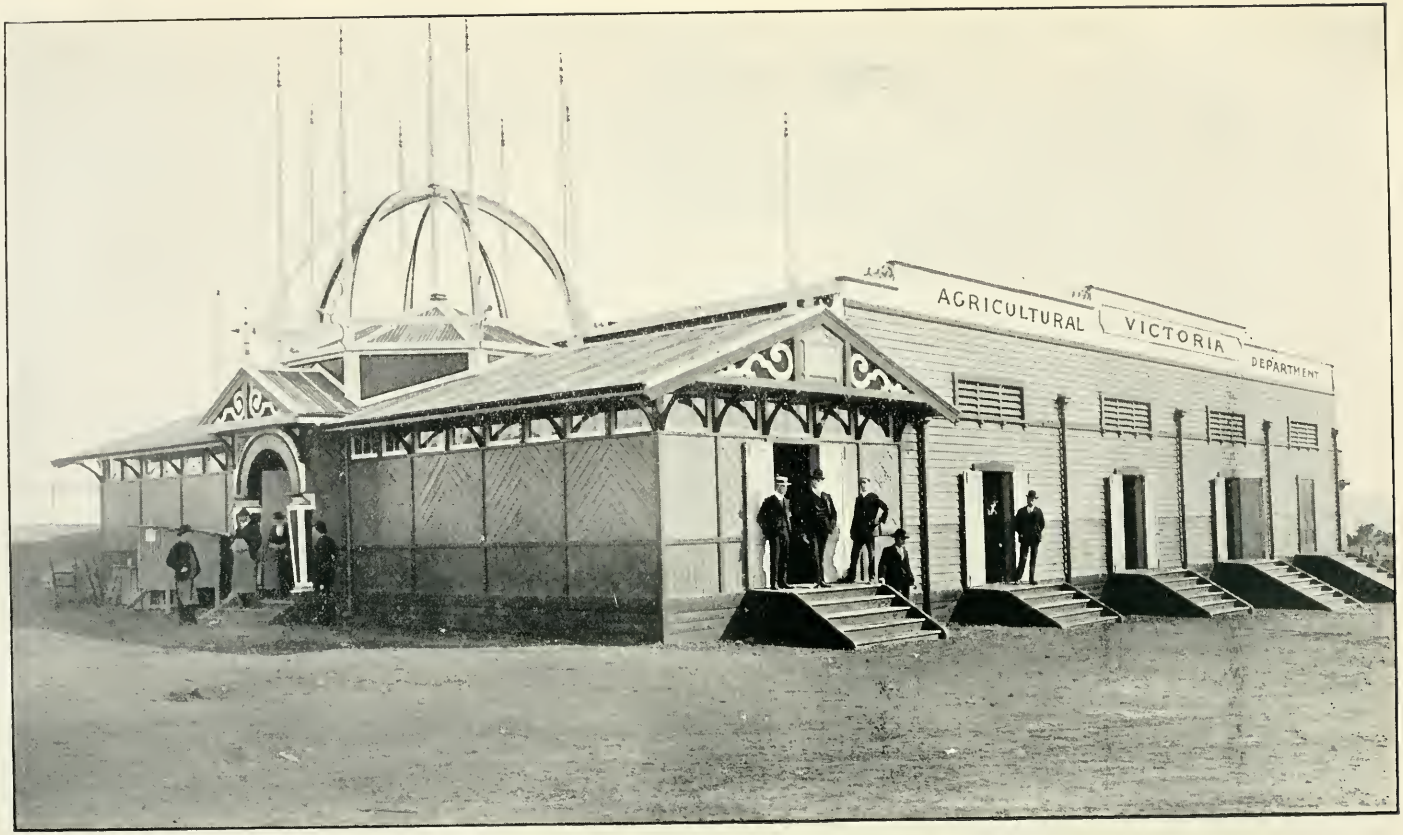
"The characteristic soil of the limestone area of Kentucky, adapted to the White Burley tobacco, may be said to maintain on an average about 20 per cent. of water.

"Records have not been kept of the manufacturing tobacco soils of Virginia, but from investigations which have been made on adjacent lands, it is probable that the mean water content of these soils, having as much as 40 per cent. of clay, will not be far from 20 to 22 per cent. of moisture."

The Mechanical Analysis of a Few Typical American Subsoils.

For comparison with the figures of the Edi soils, the returns are given below of the average results of the mechanical analysis of a large number of typical American subsoils. The very great difference in the relative clay percentage of the various soils adapted to each type of tobacco, will indicate the very important part the physical properties of the soil play in the production of the varying characteristics of the product.

Number of Sample.	Locality.	Description.	Moisture in air—Dry sample.	Organic Matter.	Gravel (2–1 mm.)	Coarse sand (1–0·5 mm.)	Medium sand (0·5–0·25 mm.)	Fine sand (0·25–0·1 mm.)	Very fine sand (0·1–·05 mm.)	Silt (0·05–0·01 mm.)	Fine silt (0·01–0·005 mm.)	Clay (0·005–0·0001 mm.)
			%	%	%	%	%	%	%	%	%	%
44	Virginia & North Carolina ..	Bright Yellow	1·10	2·24	2·57	6·39	13·67	22·02	23·45	14·08	5·43	8·23
55	Kentucky and Tennessee ..	Export	2·23	3·00	·39	·56	·73	1·93	9·50	52·50	6·28	22·59
30	Kentucky and Ohio	White Burley	3·48	4·42	·64	1·63	1·44	1·22	7·04	39·77	9·36	31·62
21	Virginia	Manufacturing	5·55	7·87	1·22	2·05	3·47	6·94	9·45	11·29	7·67	44·38



GENERAL VIEW OF BUILDING

THE DEPARTMENTAL EXHIBIT AT THE ROYAL SHOW.

By G. H. Robinson.

This year, for the first time in connection with the Royal Agricultural Society's Show, the Department of Agriculture was in a position to make a display worthy of the work which it is doing, and in some degree indicating the extent and variety of the assistance which it affords to the man on the land. The accommodation in the new building, ample as it appears at first sight, proved all too small for the demands made upon it, some of the scientific branches being quite unable to represent their work in an adequate manner in consequence of the limited space placed at their disposal. Still the new departure of grouping all the departmental exhibits under one roof must be regarded as an undoubted success, and was evidently highly approved of by the crowds who visited the show.

Dairy Branch.

From the point of view of the general public, the dairying exhibit, so well arranged by Mr. Crowe, was the most impressive, the eye of the visitor being first caught by the great tiers of boxes filled with butter, representing the daily output in the height of the season of the largest factory in the State. The number of boxes was 252 each of 56 lbs. net, a total of 6¼ tons valued at £700.

Dairymen were specially interested in the collection of butters from the various countries contributing to the London market, casks from Denmark and Siberia being displayed alongside boxes from Argentina, Canada, Ireland, Victoria, New South Wales, South Australia and New Zealand. As was only to be expected from the varied lengths of time these had been kept, and the more or less favorable periods of the season when made, the merits of the various butters could hardly be compared on an equitable basis, but there could be no denying the prime quality of the new season's South Australian, while the Irish creamery and Danish were also excellent.

Though London requires its butter in boxes, Eastern ports take a considerable quantity from Victoria every year in tins of various sizes, and samples of these from different packers were to be seen.

Cheese was shown from all parts of the world in an almost endless variety of shapes, styles and colours, ranging from the diminutive round Edal to the giant Gruyére, nearly as large as a cartwheel and much the shape of the old-fashioned solid wooden wheel. As no show of cheese would be complete without the veined Stilton and the fragrant Gorgonzola, both these were there, as also the less expensive but more widely eaten Cheddar from Canada and New Zealand.

To townspeople the cases of dried milk appealed perhaps more strongly than anything else. Many found it difficult to believe that

the light cream coloured powder was milk minus the water and the germs, and were somewhat sceptical as to its value till they had tested a sample of the new product. The housewife now looks forward to the day when she will buy her milk, like sugar in a paper bag, from her grocer.

During the course of the Show, instruction in testing milk and cream by means of the Babcock tester was given by Messrs. Archer and Carroll, dairy supervisors. Demonstrations in cheese-making on the Cheddar system were also carried out by Mr. McMillan, cheese-making expert. It would be well if these, and all similar operations, could be conducted at future shows on raised platforms, so as to give a better chance of seeing to those not fortunate enough to be in the front row. The value of such demonstrations is shown by the desire of the crowd to get a good view, and every opportunity should be given to those who desire to avail themselves of the instruction imparted.

The method of building an up-to-date circular frame silo on the most recent economical lines was easily gathered from the portion erected, adjoining the building, under the supervision of Dr. Cherry. The cost in Melbourne of material for a silo with a capacity of 100 tons has now been reduced to less than £15.

Government Cool Stores.

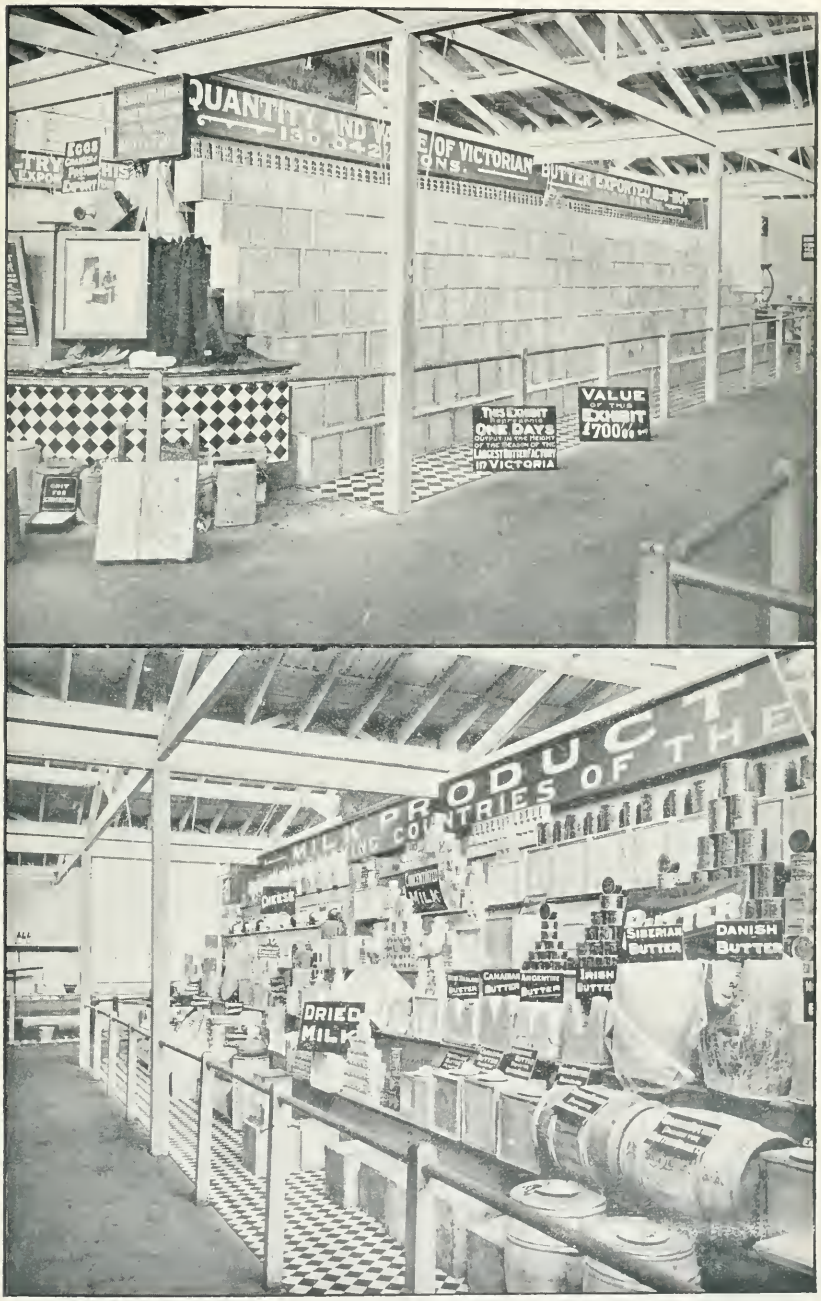
The Government Cool Stores made an imposing array with perishable produce prepared for export, such as rabbits and hares, fowls, ducks and turkeys, mutton and lamb, pork and beef. The frozen rabbits especially caught the public fancy, the splendid appearance they presented testifying alike to their quality and the skill with which they had been dressed and packed. Fowls from Russia, chickens from England, poultry and game from almost all parts of the world gave those in the local trade an opportunity of seeing how competing countries put up their products. Certainly as far as appearances went those prepared at the Government Cool Stores easily held their own.

Mr. Hart, the poultry expert, gave frequent demonstrations in dressing poultry, and from his pulpit-like structure impressed the onlookers with his skilful work. When not thus engaged, he was usually to be seen surrounded by a knot of enthusiasts, explaining to them the proper methods of packing poultry and eggs for export, or the merits of the various breeds of fowls for the table or for egg production.

In the work of inspecting for export all perishable produce except butter and fruit, Dr. Brown naturally meets with many cases of disease, so he gathered for exhibition a large and varied collection of hydatid cysts, tapeworms and such like objects of interest.

Special Industries.

A most effective and extensive display was made by Mr. Knight and his assistants, embracing samples of fibres and fibre plants, oils



DAIRY EXHIBIT

CHEESE MAKING

DEMONSTRATION OF POULTRY DRESSING BY MR. HART

METHOD OF CONSTRUCTING SILO

LOCAL AND IMPORTED POULTRY FROM GOVERNMENT COOL STORES

and oil plants, grasses and fodders of various kinds, dried and preserved fruits, cider and vinegar, wax models of the most important varieties of fruits, fruit cases and baskets, and a collection of thistles and other injurious weeds.

Mr. Knight's energies are largely devoted to endeavouring to popularise the cultivation of flax, and a breaking and scutching plant was shown in operation, the fibre turned out being of first class quality. Those who have recently gone in for flax growing on up-to-date lines are of opinion that this will eventually become a most important industry in this State, where the natural conditions are so eminently suited to the plant. The net returns are variously assessed at from £5 to £7 per acre after allowing for all expenses including rent of land, so there is reason to expect considerable development in this direction shortly.

Though show time is not the best for giving instruction in fruit preserving, owing to the comparative absence of fresh fruits, yet shift was made with what could be procured. Farmers' wives and daughters are always keenly appreciative of these demonstrations, and on this occasion many city people were not above seeking for some useful hints.

Instruction in cider and vinegar making was also given, both adjuncts to apple growing which might with advantage be more generally adopted.

Export fruit cases, both old and newer types, were shown, and the best methods of packing illustrated at frequent intervals. The merits of the new patent cases were freely discussed by growers and exporters, but most seemed averse to the adoption of any package which would tend to increase the cost of landing fruit in London.

Chemical Branch.

Typical samples of produce grown on the various experimental plots under the supervision of Dr. Howell showed in a striking manner the value of manuring. Crops of millets and sorghums grown on sandy soil at Mordialloc were increased two and three times in weight by the use of appropriate fertilizers. An object lesson, such as was afforded by samples of average plants from these experimental plots, is rarely seen, and it is much to be regretted that additional space was not available to enable these to be shown to better advantage. A fine series of photographs was exhibited illustrating the effect of various manures on all kinds of crops. Some splendid samples of tobacco from the Edi Tobacco Farm showed what can be done in tobacco growing by selection of varieties suited to the soil and climate, and proper attention to cultivation, harvesting and curing. Excellent samples of seed harvested from the experimental plots, as well as soils and agricultural produce in various stages during their analysis, were shown.

A varied collection of instruments and glassware used in the laboratory work afforded some faint suggestion of the intricate

processes which form the day's work in an analytical laboratory. Bulletins descriptive of the field work of the branch were available for distribution to those requiring them.

Entomological and Ornithological Branch.

By common consent, Mr. French's exhibit was regarded as one of the most attractive in the building. One interested in farming or fruitgrowing could study the various stages in the life histories of the insect pests with which he has to fight, and see also the characteristic injuries caused by any one of them. A knowledge of our insect foes is not complete without the study of their natural enemies, and ample evidence was afforded that this particular phase of Economic Entomology is not neglected. The nests and eggs, as well as stuffed specimens of the chief insectivorous birds of Victoria, gave visitors a chance to familiarise themselves with some of the farmers' best friends.

A fine collection of timbers destroyed by insects was a prominent feature, and the whole display was well set off by numerous coloured illustrations of injurious and beneficial insects.

Pathologist's Branch.

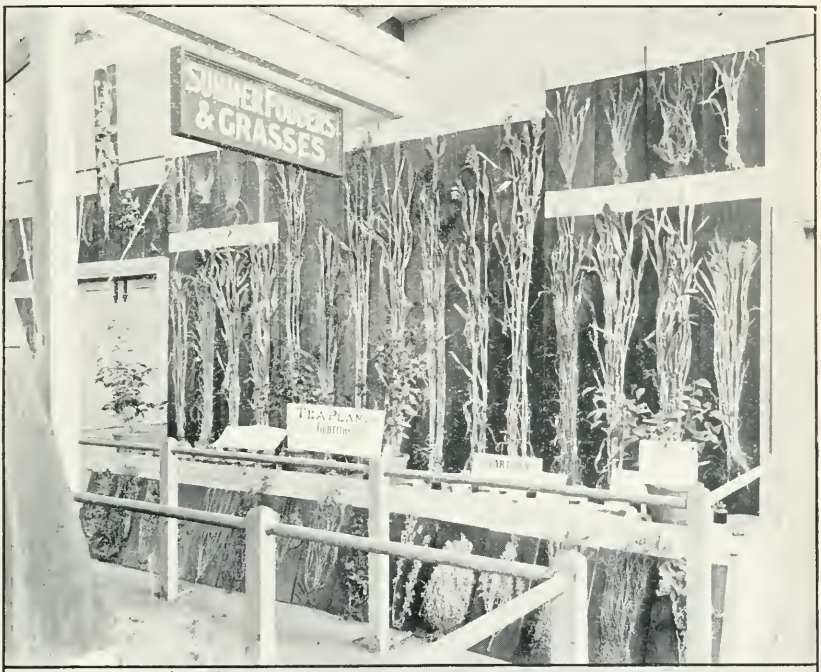
Of special interest in this section was the extensive collection of fungus diseases of fruit trees and farm and garden crops, some being shown dried and mounted in cases, and others preserved in spirit, but the latter unfortunately, owing to want of space, were not shown to advantage. The centrifugal machine for testing samples of seeds, and especially grain, for the presence of the spores of smut and other diseases, aroused considerable interest among farmers.

The testing of new wheats, oats and barleys, as well as new grasses and fodder plants, is part of the work of the branch, and an extensive collection of the former were shown, as well as a complete set of our native Victorian grasses.

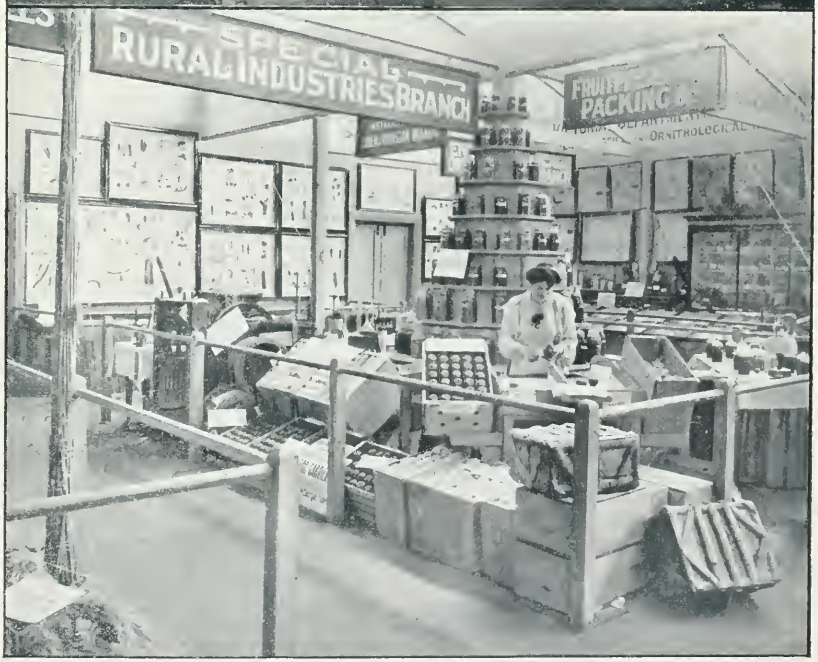
Bulletins on take-all in wheat and black spot of the apple were distributed to farmers and fruitgrowers.

Viticultural Branch.

As the reconstitution of our vineyards on resistant stocks is a matter of the greatest importance at the present time, the viticultural inspector, Mr. Adcock, took advantage of the opportunity afforded by the Show to give frequent demonstrations in bench grafting cuttings. The methods of making the various types of grafts in common use were carefully explained, and machines were shown by which the work was much simplified and the percentage of strike increased. Some grafted cuttings planted last year at Rutherglen were on view, and the vigorous growth they had made testified to the skill and care with which the operations of the Viticultural Station at Rutherglen are carried out.



SPECIAL INDUSTRIES



FRUIT PRESERVING AND PACKING

AGRICULTURAL CHEMIST'S BRANCH

ENTOMOLOGICAL AND ORNITHOLOGICAL BRANCH

VEGETABLE PATHOLOGIST'S BRANCH

Mr. Burney had four samples of wines made by him this year at the Viticultural Station, Rutherglen, all sterilized by the Salvator pasteuriser, lent to the Department. Two were dry red wines, one a typical full round export wine made from the Shiraz grape and the other a Cabernet of unusual quality. Two white wines made from White Hermitage and Gouais were remarked on by connoisseurs as having a delicacy seldom met with in the Murray Valley. The general opinion of the members of the wine trade, who tasted the wines, was that the wines were so clean, smooth and advanced for their age, that the methods of handling and subsequent pasteurisation proved the success of this system for which they predicted a very bright future.

Forestry Branch.

The beauty of grain of some of our "common" hardwoods and their generally handsome appearance were well shown in the new timber trophy built for the Forestry Branch under instructions from the Director. The trophy took the form of a room without a roof, each wall being composed of numerous square or oblong panels, suitably polished and occasionally carved, the whole being designed for Mr. A. W. Crooke of the Forestry branch, by Mr. G. H. B. Austin of the Public Works Department, with a view of showing the good qualities of our hardwoods for decorative work or the manufacture of furniture. The woods used for the purpose were such as are ordinarily deemed fit only for fencing posts, floor joists and railway sleepers:—blue gum, red gum, mountain ash, grey box and ironbarks forming the major portion. The beauty of the trophy came as a surprise to all but a few enthusiasts who were already aware of the value of these woods for high-class fittings and cabinet work. It would seem to be only a matter of time when these timbers will be properly appreciated and eagerly sought after for work of this kind.

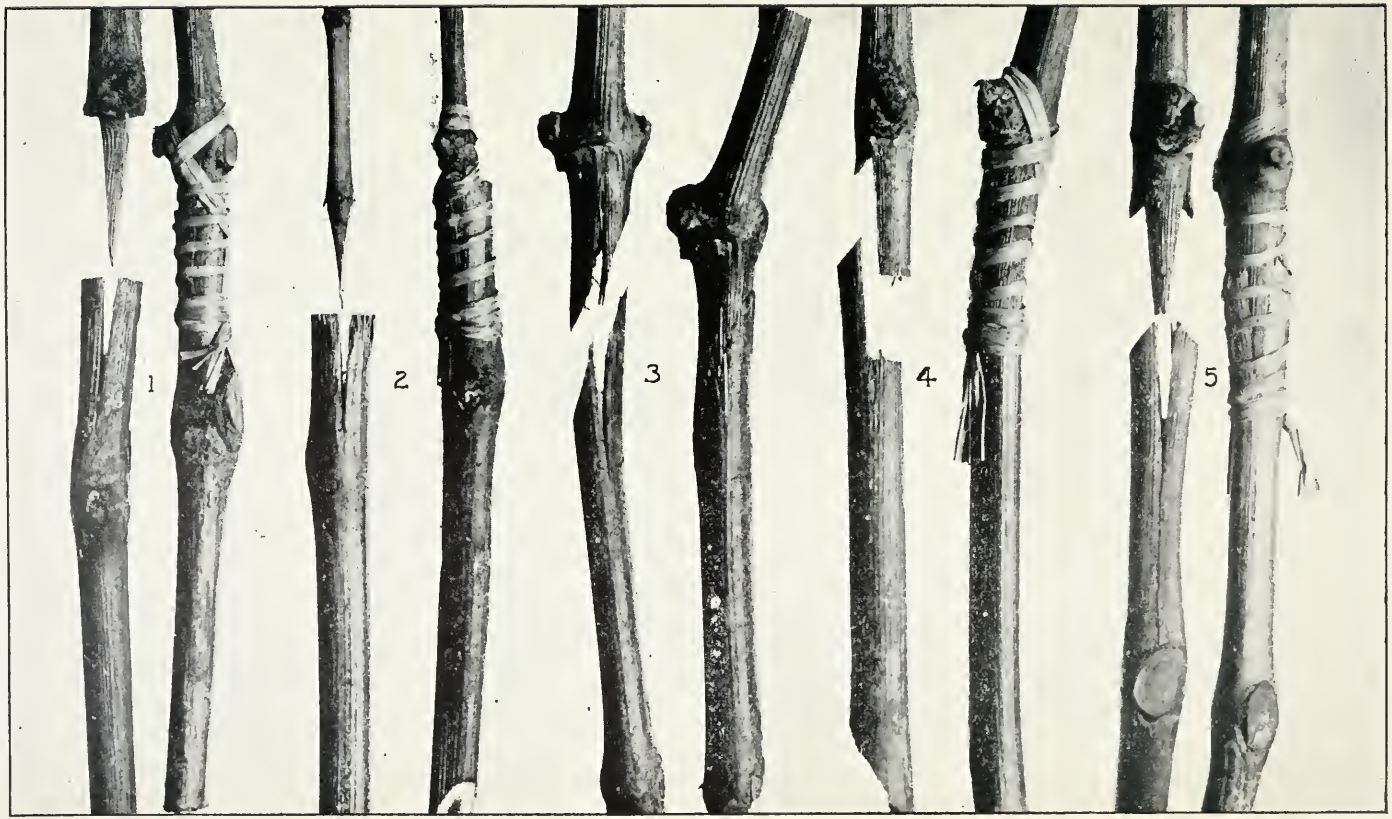
Dookie Agricultural College.

Though distinct from the Department and under the control of the Council of Agricultural Education, the Dookie College, being one of the most important factors in the State's system of technical agricultural education, appropriately enough was accommodated in the same building. Mr. Pye, the principal, made good use of his opportunity to show the public what Dookie is doing. Wealth of production was the impression left on one's mind after viewing the splendid collection of samples of all kinds of agricultural produce effectively displayed. Wheat, oats, barley, broom corn, sorghum, wines, olive oil, dried and preserved fruits, butter and cheese, fodder and leguminous plants, all grown or manufactured at the college by the students under the supervision of the staff, afforded some idea of the varied instruction imparted at this institution.

Poultry receives a large share of attention at Dookie just now, an egg laying competition being in full swing, the leading pen of six

White Leghorns, laying 545 eggs during May, June, July and August. A dozen eggs from each of the various breeds was shown, and afforded a chance for comparing them. For chicken feed Mr. Pye speaks most enthusiastically of canary seed, and exhibited samples from the crop of this grass over 7 feet high.

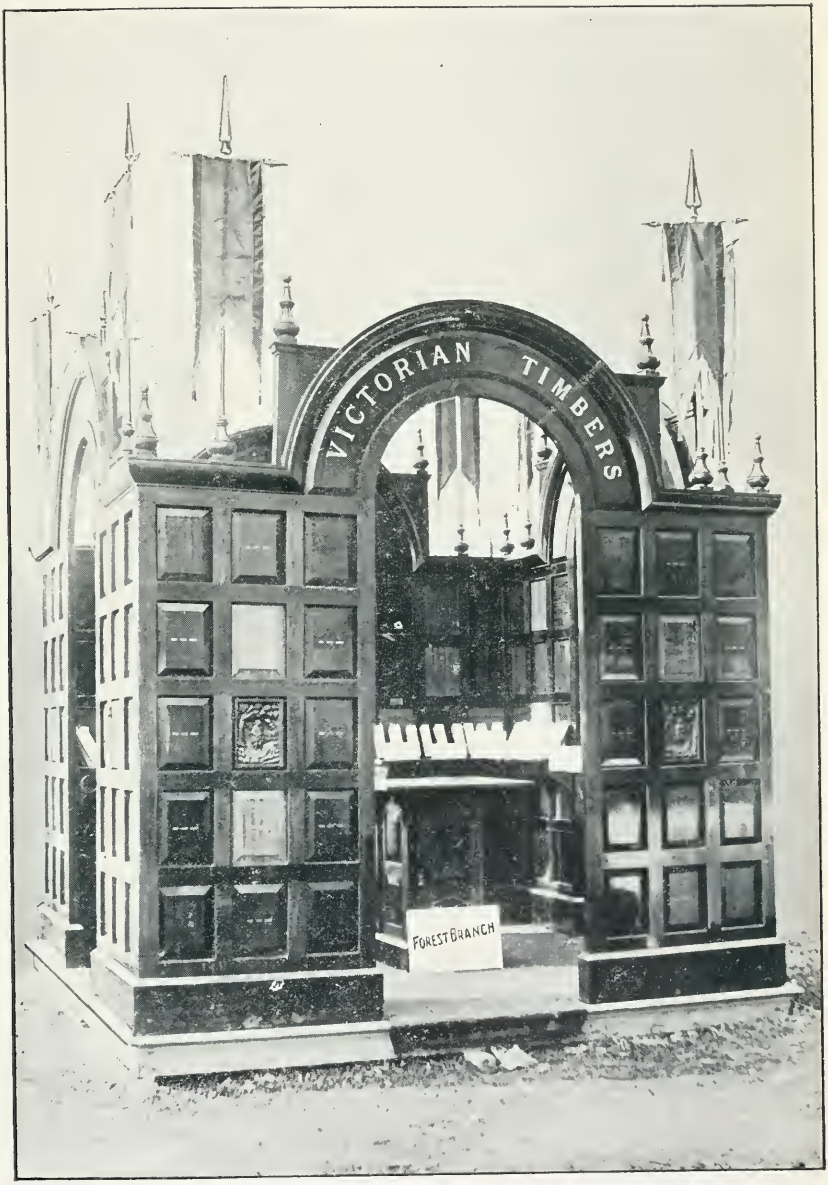
Some very good views of the College, wine cellar, butter factory and other buildings, the cow yards and fowl runs, the orchard and vineyard, enabled one to gather some idea of the college and its surroundings, but to fully appreciate what the institution is doing in the teaching of scientific and practical agriculture nothing short of a personal visit would suffice.



G. H. Robinson, Photo.

TYPES OF GRAFTS.—VITICULTURAL BRANCH

1. Shoulder Cleft; 2. Cleft; 3. Whip Tongue; 4. Rutherglen Side; 5. Aglate Machine.



TIMBER TROPHY EXHIBITED BY FORESTRY BRANCH

DOOKIE AGRICULTURAL COLLEGE EXHIBIT

THE COMPARATIVE VALUE OF MILK FOR CHEESE AND BUTTERMAKING.

By R. T. Archer.

Although all our butter factories are paying for milk according to butter fat contents, it is surprising to find that there are still many cheese factories paying for milk at per gallon, irrespective of quality as indicated by the butter fat contents, and also that there are many experienced cheesemakers who do not know, or are not seized with the importance of the fact that the percentage of fat found in the milk by the Babcock tester is quite a reliable guide to the value of milk whether for making butter or cheese or for concentration.

Let us look at the composition of milk and compare it with that of its products.

Analysis of Cow's Milk.		Analysis of Butter.	
Water	87·5 %	Fat	84 %
Fat	3·6 %	Moisture	12·5 %
Casein	2·8 %	Soluble salts	3·2 %
Albumen	·6 %	Ash	·3 %
Sugar	4·75 %		
Ash	·75 %		
	100·0 %		100·0 %

From this we see that one pound of fat in milk will produce on an average 1·16 lbs of commercial butter.

Average Composition of Cheddar Cheese.		Average Composition of Whey.	
Fat	35 %	Water	93·0 %
Water	32 %	Albumenoids	1·0 %
Casein	26 %	Fat	0·3 %
Milk sugar and mineral matter	7 %	Milk sugar and lactic acid	5·0 %
		Ash	0·7 %
	100 %		100 0 %

The higher the percentage of fat the higher the percentage of water and the lower the percentage of casein. Dr. Howell analysed a sample of cheese lately containing :—

Fat	39·15 %
Water	32·84 %
Casein	24·45 %
Ash	3·55 %
	99·99 %

The solids which are saved in the manufacture of cheese are casein, fat and a portion of the ash.

Nearly all the albumen and sugar, about one-third of the ash, and a small part of the fat and casein escaped during the course of manufacture into the whey.

Before the introduction of Dr. Babcock's method of testing milk it was the general impression amongst dairymen that milk poor in butter fat was rich in casein, and was consequently worth more for cheesemaking. Both fat and casein are constituents of cheese, and are found to be of nearly equal importance, and that for milk containing a normal percentage of fat the amount of cheese produced is in nearly exact proportion to the percentage of fat in the milk.

Professor Van Slyke, in a series of investigations extending over several years, and including the milk of over 1,500 different cows, found as the percentage of fat increased the percentage of casein increased in nearly constant ratio, or to quote his own words, "While we have noticed considerable variation, when we consider individual herds we have found that, as a rule, there were two-thirds of one pound of casein for each pound of fat in the milk, whether the milk contained 3 or 4 per cent of fat. When the amount of fat in the milk increased beyond 4·5 per cent. there was a gradual but slight diminution of casein for each pound of fat." This normal relation is sometimes disturbed in a season of drought, when the cattle are nearly starved. A case of this description was brought under my notice by a cheesemaker last year, where at one factory from

26 718 gallons of milk
25·214 pounds of cheese were made.

1·504 pounds less than 1 pound per gallon.

At No. 2 factory,

30·846 gallons of milk
28·471 pounds of cheese.

2·375 pounds less than 1 pound of cheese per gallon of milk

The average price at No. 1 factory was 5.44 pence per gallon, the price at No. 2 factory was 5·54 pence per gallon. There was very little difference in value of the milk at these two factories as estimated by the Babcock tester, but the result showed a considerable difference in favor of No. 1 factory in the amount of cheese produced. In the district from which No. 1 supply was drawn there was plenty of good feed for the cattle, while in the district from which the supply of No 2 factory was obtained the pastures were bare owing to a long spell of dry weather. This case was submitted to Professor Farrington, of the Wisconsin Agricultural Experiment Station, U.S.A., and he said they had had similar experience, and this was due to the cattle not having sufficient nourishing food. These exceptions to the general rule only go to show that milking cows should at all times be liberally fed, and does not in any way affect the subject we are dealing with.

Further, considering the percentage of fat as influencing the weight of cheese produced it is found that as the percentage of fat increases over 4·5 the percentage of casein is slightly less in proportion to the fat, and also that the yield of cheese per pound of fat in the milk is slightly less. But against that a rich milk has a higher value in that it increases the average quality of the cheese, and

though containing slightly less casein, the total return is not reduced in the same proportion, because a cheese rich in fat will contain more moisture than one which contains less fat.

The following tables give the data on which Professor Van Slyke's opinions were based :—

TABLE SHOWING RELATION OF FAT TO CASEIN IN NORMAL MILK.

Group.	1 per cent. of Fat in Milk.	No. of Samples.	Average per cent. of Fat in each group.	Average per cent of Casein in each group.	Average lbs. of Casein for each lb. of Fat.
1 ..	3 to 3·5	22	3·35	2·20	0·66
2 ..	3·5 to 4	112	3·72	2·46	0·66
3 ..	4 to 4·5	78	4·15	2·70	0·65
4 ..	4·5 to 5	16	4·74	3·05	0·64
5 ..	5 to 5·25	7	5·13	3·12	0·61

TABLE SHOWING THE RELATION OF FAT IN MILK TO YIELD OF CHEESE.

Group.	Per cent. of Fat in Milk.	Lbs. of Green Cheese made from 100 lbs. of Milk.	Lbs of Green Cheese made from 1 lb. of Fat in Milk.
1 ..	3 to 3·5	9·14	2·73
2 ..	3 5 to 4	10 04	2·70
3 ..	4 to 4 5	11·34	2·73
4 ..	4·5 to 5	12 85	2·71
5 ..	5 to 5·25	13·62	2·66

Another erroneous impression that has held the minds of cheese-makers is that in the case of rich milk all the fat over a certain percentage is lost in the whey, but this is clearly refuted by the results of a further series of experiments by Professor Van Slyke, and embodied in the following table, which have been confirmed by other investigators :—

TABLE SHOWING AMOUNT OF FAT LOST AND RECOVERED IN MAKING CHEESE.

No of Experiment.	Lbs. of Fat in 100 lbs. of Milk.	Lbs of Fat lost in 100 lbs. of Milk.	Lbs. of Fat recovered in 100 lbs Milk.	Lbs. of Fat lost in Whey from 100 lbs. Fat in Milk.	Lbs. of Fat recovered in Green Cheese from 100 lbs. of fat in Milk
1 ..	2·35	0·154	2·196	6·55	93·45
2 ..	3·01	0·193	2·817	6·42	93·58
3 ..	3·88	0·277	3·603	7·15	92·85
4 ..	3·96	0·283	3·677	7·14	92·86
5 ..	4·70	0·359	4·341	7·64	92·36
6 ..	4·73	0·321	4·399	6·99	93·01
7 ..	4·80	0·373	4·427	7·77	92·23
8 ..	6·49	0·715	5·775	11·01	88·99
9 ..	3·70	0·269	3·431	7·26	92·74

From the above it will be seen that only in the case of No. 8, which was milk abnormally high in fat, namely 6·49 per cent., was there any material difference in the amount of fat lost or saved in milk with the fat varying from 2·35 to 4·8 per cent. We have no explanation of the cause of the increased loss in the case of the rich milk in this instance, but the probability is that the bulk of the milk

was from the Jersey or Guernsey cow, as we know the milk from these breeds is on an average much richer than the other breeds, and we also know that the fat globules in milk from these breeds are much larger than those of other breeds and consequently separate more easily and are more easily lost in the whey. We must not conclude from this that these rich milking breeds are not suitable for cheesemaking, as trials have been made which directly prove otherwise, and as they bear on this subject may be considered here.

In the cheesemaking tests at the Chicago Show 25 cows of each breed were tested for 15 days, the results being as follow :—

	Milk.	Cheese.	Whey.	Gain Live Weight.
Jersey	13,296·4 lbs.	1451·76 lbs.	11,578·7 lbs.	327 lbs.
Guernseys	16,938·6 ,,	1130·62 ,,	9,667·7 ,,	480 ,,
Shorthorns	12,186·7 ,,	1077·6 ,,	10,838·9 ,,	709 ,,

Trials of breeds for cheesemaking at the Geneva Experiment Station, New York, showed that it cost less to produce a pound of cheese from rich milk than poor milk, as will be seen by the following figures :—

	Holstein.	Ayrshire.	Guernsey.	Jersey.
Per cent. of fat	3·36	3·60	5·30	5·60
Cheese yield per cow ..	755 lbs.	681 lbs.	703 lbs.	685 lbs.
Cost of cheese per lb. ..	3⅜d.	3⅜d.	3¼d.	3¼d.
Profit per cow	£2 10s. 1d.	£1 9s. 2d.	£2 17s. 9½d.	£2 15s. 1d.
Relative profit	172	100	198	192

From a study of the above we must see that the only equitable basis on which to pay for milk, whether it be for butter or cheesemaking, is according to its fat content. Besides the actual monetary consideration there is a moral aspect of the question. In every community there are always some who are not honest, and if these are supplying a cheese factory where the milk is pooled, or all paid for at the same price per gallon, it will not be long before they will discover that they can add water and so increase their quantities, and at the same time their returns, at the expense of their honest neighbours. If the milk is paid for by test it does not much matter if water is added, provided it is clean water. You can always tell approximately how much water is added by the use of the Babcock and the lactometer. Many of the factory managers will know how to make the test, but those who do not know will find it described in the *Journal*. I tested the milk of a supplier at a factory a short time ago and found 20 per cent. of added water. Had this been pure water it would not make any difference as the milk was paid for according to its butter fat contents.

Another factory had some suppliers with a 3·6 test and others at 4·6, but both were paid the same price per gallon, although the last was worth about a penny a gallon more than the first. Thus :—

1,000	gallons	of milk	testing	3·6	will give	397 lbs.	butter, at	8d. =	£13	4 8
1,000	,,	,,	,,	4·0	,,	444	,,	8d. =	14	16 0
1,000	,,	,,	,,	4·5	,,	504	,,	8d. =	16	16 8

In the table given above showing the relation of fat in milk to the yield of cheese it will be seen that about $2\frac{3}{4}$ lbs. of cheese is produced for every pound of fat in the milk, so that milk containing 3·5 per cent., or $3\frac{1}{2}$ lbs. of fat in 100 lbs. of milk, produces $9\frac{1}{2}$ lbs. of cheese, and milk containing 4·5 per cent., or $4\frac{1}{2}$ lbs. of fat in 100 lbs. of milk would produce $12\frac{1}{4}$ lbs. of cheese, a difference of nearly 25 per cent. in favor of the latter. The officers of the department are continually advising suppliers to test their cows to ascertain which are giving returns that will cover the cost of production and leave a margin of profit, but while the above rule is adhered to there is not much inducement for them to adopt the system, as quantity and not quality will be the aim. If, however, we are to compete successfully with other countries we shall have to pay much greater attention to this feature of the business. For while the Victorian cows average a little over 300 gallons of milk per annum, those of our European rivals average more than double the quantity.

Now turning to the question of cheese *versus* butter. Take 25 lbs. of milk at 3·6 test, this will give one lb. of butter at 10d., say, and 2 gallons of skimmed milk, 1d., equal to a total of 11d. for $2\frac{1}{2}$ gallons. The same milk should give about $2\frac{1}{5}$ lbs. cheese, which at 5d. per lb. equal 11d., 2 gallons of whey at $\frac{1}{4}$d. is equal to $\frac{1}{2}$d. This gives a total value for cheese of $11\frac{1}{2}$d. against 11d. for butter. The following deductions may be made for cheese in excess of butter:—5 per cent. interest on money on cheese curing for three months, ·15d.; difference on freight of 1 lb. of butter and $2\frac{1}{5}$ lbs. of cheese, say ·35d.; total deduction $\frac{1}{2}$d, this brings the returns for cheesemaking down to 11d. Worked out on this basis, we find that cheese at 5d. per lb. on the local market is equal to 10d. per lb. for butter, that is taking cost of making and marketing of the butter and cheese as being equal.

I give here a table showing a comparison of the value of cheese and butter on the London market:—

Cheese per Cwt.		Butter per Cwt.		Cheese per Cwt.		Butter per Cwt.	
s.	d.	s.	d.	s.	d.	s.	d
35	0	66	$0\frac{1}{2}$	53	0	100	0
36	0	67	11	54	0	101	$10\frac{1}{2}$
37	0	69	$9\frac{3}{4}$	55	0	103	$9\frac{1}{4}$
38	0	71	$8\frac{1}{4}$	56	0	105	$7\frac{3}{4}$
39	0	73	7	57	0	107	$6\frac{1}{2}$
40	0	75	$5\frac{1}{2}$	58	0	109	5
41	0	77	$4\frac{1}{4}$	59	0	111	$3\frac{3}{4}$
42	0	79	$2\frac{3}{4}$	60	0	113	$2\frac{1}{2}$
43	0	81	$1\frac{1}{2}$	61	0	115	1
44	0	83	0	62	0	116	$11\frac{1}{2}$
45	0	84	$10\frac{3}{4}$	63	0	118	$10\frac{1}{2}$
46	0	86	$9\frac{1}{2}$	64	0	120	9
47	0	88	8	65	0	122	$7\frac{1}{2}$
48	0	90	$6\frac{3}{4}$	66	0	124	$6\frac{1}{4}$
49	0	92	$5\frac{1}{2}$	67	0	126	$4\frac{3}{4}$
50	0	94	4	68	0	128	$3\frac{1}{2}$
51	0	96	$2\frac{1}{2}$	69	0	130	$2\frac{1}{4}$
52	0	98	$1\frac{1}{4}$	70	0	132	$0\frac{3}{4}$

From this it will be seen at a glance what cheese should realise to be equally profitable to butter at a given figure. For instance, some time ago, the cabled quotation of the price of the best New Zealand cheese in London was 39s. per cwt., while butter was 83s. From the above table cheese should be 44s. or 5s. higher to be equal to butter, or that if butter dropped to 73s. 7d. it would still be as good a value as cheese.

These figures were compiled in May since which time the value of Victorian butter in London has advanced to 114s. per cwt. while cheese has only advanced to 45s. according to the latest returns and it should be 60s. per cwt. to be equal to butter.

NOTES ON THE USE OF THE HOME SEPARATOR.

By P. J. Carroll.

The private separator question has been much discussed in the past, both in the press and at factory managers' conferences, and sometimes the criticism was favorable, but just as often otherwise. A few people held a brief for the private separator, while those against it were frequently misunderstood. The chief objection was aimed at its introduction into districts where facilities already existed for the treatment of the whole milk supply. In many places not only is the home separator indispensable, but a perfect boon in portions of Gippsland where the delivery of whole milk is impracticable, owing to bad roads and isolation. Under those conditions it has been the means of development in localities that would otherwise have remained unproductive.

Those who were in a position to point out the disadvantages were overwhelmed by the numbers of agents and people who were interested in the sale of machines, many of whom used specious means to introduce them. No objection is taken to the home separator itself, but to the consequences of its adoption and use. Having had it now for a considerable time, we are in a position to judge of the results, and it cannot be denied but that the butter made from milk supply factories is infinitely better.

When the system expanded and dairying operations extended, all the efforts put forward to keep up the standard quality of the butter proved inadequate to cope with this rapid increase. Nobody could gainsay the fact that we have been fortunate in the world's market, in getting prices closely approaching top rates for this class of butter, in fact, closer than could be obtained on the local market. Increased competition, however, from Siberia, Argentina, and other new butter producing countries will tend to widen this margin, until the making of butter below first grade will become unprofitable.

Influence on the Quality of Victorian Butter.

The deterioration of the average quality of Victorian butter has been talked of for a long time. As far back as 1900 the Exported Products Board, appointed to inquire into this matter, made the following comment on the influence of the growing use of the home separator on the quality of Victorian butter:—

"Foremost amongst the causes of deterioration is the use of the home separator. The small separator used by the milk producer himself on his farm is not in itself an evil. On the contrary, if

rightly used, it has distinct advantages for to the settler remotely situated, especially in districts with bad or mountainous roads over which milk could not be carted, it makes dairying possible where otherwise it would be impossible. These advantages are readily appreciated by the milk producer, who, however does not see the evils behind them. The cream, which should be cooled by a refrigerator and put under skilled control at once, is kept on the farm at uncertain temperatures, and exposed to contamination from various sources until the farmer has enough to cart away. He delivers it twice a week in summer and in the winter often only once a week, in some cases once a fortnight. To anyone with an elementary knowledge of buttermaking, it is obvious that choicest butter cannot be made from such cream, even where the farmer is scrupulously clean in all his methods, and where he is otherwise nothing but a second or third grade butter can result."

Any person continuing to read this report requires no further evidence of the superiority of butter made by those factories which work on the basis of a milk supply and of the inferiority of the average butter made from cream supplied under the then existing conditions. Farmers did not go into the business with their eyes closed, as they were warned, from time to time, of the danger, and the home separator was unhesitatingly condemned in districts where milk supply was practicable. The position was not realised a few years ago. Few people had any idea that the system would assume such large dimensions, and when the warning note was sounded it was laughed at, even by the factory managers themselves. They were told the day would come when their eyes would be opened. That time is now at hand for those who have not had that experience. Home separator agents have done their work faithfully and well, seldom have they failed to use any weapon that would help them to gain their own ends. About seventy per cent. of the dairymen are now placed in possession of their own separators—many of them would have been better without them.

As I said before the home separator is indispensable. There are plenty of new fields for the separator man to exploit, but I will continue to protest against its introduction and adoption in districts which can be more economically and better served by the supplying of the whole milk to the factory. On the other hand, I will put forward every effort (and I know those responsible for the welfare of this important industry are with me) to guide and educate the users of the home separator to enable them to raise the quality of the butter to the highest standard.

Frequently have I been present at cream factories when a load of cream arrived, and I have watched with interest the grading process by the manager when such phrases as the following escaped his lips:—"Very stale," "Too sour," "Weedy," "Tinny," "Indescribably bad," "Rotten," and "Fermented." The latter verdict is given without examination, as its mushroom appearance speaks for itself. Now, what factory manager could make first quality butter out of

such stuff as this? No wonder the quantity of second quality butter increased, and the making of first quality butter became confined to milk supply factories, and a very few of the best managed cream factories. The result achieved by these few factories, let it be said, reflects the greatest credit on the management.

Remedies.

It is in dealing with this state of affairs that most of our time is engaged, but the tremendous nature of the task makes it difficult to overcome.

Our efforts have been directed towards the rejection of unsuitable cans, proper storing of cream on the farm, cleanliness in all details and a regular delivery of cream. Most cream immediately after separation is in a condition, if properly looked after, to make good butter. The sooner it is placed in the hands of the managers the better are the chances of the resulting butter being good.

The proper ripening of cream requires scientific knowledge, and expensive buildings and appliances, then how can it be successfully done on the farm, for even though the farmer may have the knowledge the facilities are absent, and he thinks the consequences are too insignificant to warrant the necessary time and expense, let alone the skill.

Difficulty of transit over bad roads and isolation were the chief objections raised to the supply of milk to the factory. With the use of the private separator the bulk has been reduced by nine-tenths, consequently this difficulty does not now exist. If dairymen would not think of keeping their milk on the farm long enough to allow it to depreciate in value, why then should the fact of reducing it to cream be an excuse for keeping it to deteriorate? It may be argued by dairymen that the quantity produced does not warrant the time its production occupies, but if dairying is made a speciality then the produce requires special treatment. The farmer who does not care whether his cream makes good butter or not should not be allowed to become a parasite.

Although there are individual dairymen who take good care of their cream, unfortunately this cannot be said of the average. A lower price is received for this inferior cream, and this is the penalty for the carelessness of the dairymen, and, according to the present system, this tax has to be borne equally by the careful as well as the careless.

Cream Collecting by the Factories.

This has been established in some districts by a few factories, and has proved a boon to the factory managers and dairymen alike. If it were generally adopted immense benefit would accrue to all concerned. Daily delivery of cream is practicable in most places. It only requires the establishment of depots, and the sending round of carts daily to pick up the cream. Difficulties, of course, would be encountered, but would disappear with experience, and the improved

price obtained for the butter, as well as the concentration of business in the local factory, would amply repay the cost of the service. A few outlying suppliers might not be included in the service, but their cream could be churned separately, and paid for according to value, and not be allowed to injure the quality of the better class.

Defects in the Present System of Collecting.

If the companies carrying out this system of collecting could resist the temptation to poach on the territory of the neighbouring factories, and make the visits in their own locality more frequent much more good could be done. When a company extends its operations so as to overtax the equipment provided for this purpose the consequence is a curtailment of visits to suppliers, thereby defeating the object aimed at. If a better understanding prevailed amongst the different co-operative companies, and some uniform system were put into force much better progress would be made. One could understand this competition for supply between private purchasers of cream, but where the service is co-operative nothing is to be gained by the overlapping of the collecting waggons—in fact, the reverse is the case, as the duplication of the system increases the cost of manufacture.

Grading Cream.

Strict grading of all creams, and payment of differential rates should be the rule in every factory. The manager's aim should be to produce at least one brand of prime quality, be the output great or small, and at all times endeavour to increase the quantity of that standard.

If this system were carried out in all factories, suppliers of bad cream would soon cast about to find out the cause, and apply a remedy, and would welcome instruction and assistance. If something is not done in this direction, and done quickly, we will find it difficult to maintain even our present hold on the world's market, owing to the powerful and increasing competition of other countries.

Running Separators.

This matter requires closer attention on the part of the users to ensure better skimming. In my travels I have taken and tested many specimen samples in different parts of the State, for the purpose of illustrating the loss which takes place from this source. So as not to exaggerate the amount I have allowed a maximum of .06 per cent. fat; all over that I consider waste. Many of the samples tested up to ·5 per cent. and the lowest was ·05 per cent. The following are a few examples:—

	Gallons Daily.	Excess of Fat.	Loss of Fat in Year.
No. 1	70	·4 %	1,252 lbs.
No. 2	100	·35 %	1,190 ,,
No. 3	140	·30 %	1,428 ,,
No. 4	135	·20 %	918 ,,
No. 5	50	·10 %	170 ,,

This is a sample of the loss which is taking place on the above dairy farms yearly. Assuming that the average excess of fat in the skim milk is ·1 per cent., and that the quantity of milk put through the private separator is 7,728,000 gallons yearly the actual loss of fat would be 73,329 lbs. It will be seen by the above that there is a serious leakage of the dairymen's profit in this direction, and very often this discrepancy is attributed to the factory manager who treats the cream, and not to its proper source—the separator.

I have a few special lots here which I did not include in the above average, but which I will give you for your own information.

No. 1	tested ...	...	...	1·4 %
No. 2	,, ...	...	...	2·6 %
No. 3	,, ...	...	...	·8 %

Factory managers might do a lot to obviate that loss by encouraging their suppliers to send in samples of skim milk frequently to be tested. Variations of the butter fat contents of the cream would be often traceable to this source, and if it could be clearly proved to the suppliers that this was the case much more pleasant relations would exist between factory managers and cream suppliers.

DRY RED WINES AND THEIR TREATMENT.

By M. d'A. Burney.

Part III.

After first racking, certain defects may become noticeable in some of the wines in the cellar. It is not within the scope of this article to touch more than briefly upon the many and varied diseases to which wines are liable. If care has been exercised to ensure a steady and even fermentation, and the wine run into clean casks which are kept filled, there should be little if any danger from disease and consequent deterioration. By persistent and systematic cleanliness the germs of disease are kept out of the cellar, and the danger of contamination is minimised if not entirely avoided. No expense should be spared in this connection, and if a cellar is once thoroughly clean, keeping it clean afterwards is but a small item. Occasionally the composition of a wine is such that it is prone to disease or in some way defective, and we can now examine a few of the causes of the defects in export wines at this stage.

Cloudiness.

Wines that do not clear down as soon as all fermentation has ceased may at any time deteriorate and become unmarketable. The cause of a persistent cloud may be either owing to a want of tannin to coagulate the albuminous matters that are present naturally or else the commencement of microbian disease. In either case the wine must be clarified at all costs, either by the addition of tannin followed by a fining or else by filtration. It may probably be suggested that such a treatment of a wine only a few months old is premature. No treatment can be premature which ensures the preservation of a wine by eliminating the commencement of disease or deterioration. It is by such attention in the very earliest stages that defects may be avoided. If the commencement of disease is already noticeable to the palate, the wine should be at once clarified and pasteurised. There is no other safe treatment for wines affected by acetic, lactic, mannitic or any other microbian disease.

Excess of Acidity.

A real defect to an export wine is an excess of fixed acidity, arising as a rule from the grapes being under ripe. The requirements of the market are such that a wine must be even deficient in acidity to suit the palate of the consumer. It is difficult to suggest any chemical remedy to destroy this excess of acidity, and there are few if any alkaline substances that will neutralize this excess without leaving an objectionable flavour in the wine. The safest method is to hold the wine until the following vintage, and then blend it with a new wine deficient in acidity. This blending wine can easily be obtained

by letting some Shiraz or other red grape ripen to over maturity, and at the time of fermentation reducing the sugar strength by the addition of Doradillo or some other characterless grape of conspicuously low sugar strength. The addition of water for this purpose is contrary to the Victorian Wine Adulteration Act.

The too acid wine loses its acidity as it matures, and when blended with the new specially prepared wine only a year in age is lost, and the wine will become marketable, while otherwise it may be impossible to find a buyer for it.

Bitterness.

There are two separate and distinct types of bitterness, one owing to too long contact with the skins, and the other due to disease. In the first case the bitterness is due to an excess of tannin, and is easily remedied by fining by some gelatinous substance which will precipitate this excess of tannin in the form of an insoluble tannate. In the second case the wine must be pasteurised and then fined, when the germs of the disease will be precipitated with the finings.

Stringy Wines.

In some districts of Victoria, red wines which are quite palatable up to 12 months of age gradually acquire a taste of string, lose their body, become thin, astringent, and characterless. This arises from the defective composition of the wine in the first instance through there being a want of tannin, body, and often alcohol. The remedy is an addition of tannin at the commencement of fermentation, and at first racking the wine should be fortified to 26 per cent. These wines when blended with the fuller and fruitier wines of the Murray district become readily suitable for export.

Mousiness.

Often wines, otherwise sound, acquire a sickening aftertaste that can only be likened to the taste of the smell of the mouse. Occasionally this flavour appears quite suddenly and disappears after sulphuring, but as a rule there is no remedy for a wine badly affected and which is only fit for the still. Where there is danger of this taint, the wines must be cleared as soon as possible and never racked in contact with the air, and if possible pasteurised. The writer has experimented with the pasteurisation of wines slightly mousy with good results only in the case of wines not previously oxidised. The cause is probably a diastasic action in connection with the albuminous substances in the wine, which is accentuated by any over aeration or neglect.

Mouldiness.

It is only a question of degree when a mouldy wine can or cannot be made marketable. If the flavour is pronounced, the common treatment by oil is practically of no avail apart from the costliness of the process. If the taint is only very slight a fining with at least

one pint of fresh olive oil per hogshead, followed by pasteurisation, will give good results. In the long run it is better to distil a mouldy wine as soon as it is noticed as it will rarely pay for treatment, and if the disease be advanced there is a danger of the spirit produced becoming tainted.

The wine maker should never be a wine doctor. The defects that his wines may occasionally have should be remedied in their very earliest stages, or else the wines should be at once distilled. In hot climates, where high temperatures add to the difficulties of cellar work, the rational process which will soon become universal will be the sterilization of all wines as soon as fermentation has ceased. Improved methods are being discovered every day to preserve all forms of perishable foods, and yet wine seems the very last to be considered worthy of a treatment that is as economical as it is efficacious. The amount of wine that is annually distilled in Victoria is out of all proportion to the production, and the cause, quite apart from the demand for spirit, can be safely credited to the careless, ignorant, and even dirty methods of handling wine. How often when entering a cellar is the vitiated air more reminiscent of a vinegar factory. During vintage the skins and stalks are left to breed disease within a few yards of the cellar. Where by chance there are drains they are seldom cleaned. The stillages and outside of the casks are often coated with a layer of spilled wine or lees as is the floor, which for appearance sake occasionally receives a few handfuls of lime. Under these conditions, which are more frequent than most people would suppose, with every encouragement given to the breeding of the very germs that should be most avoided, it is no wonder that the wines become contaminated. The walls and ceiling, and stillages, should be kept whitewashed with a lime wash to which is added a little sulphate of copper. The outside of the casks should be kept clean with clear lime water, special attention being given to the bungs and bung holes. Where bung cloths are used they should be frequently changed and boiled. Drains in a cellar can be kept clean with permanganate of potash or per-chloride of mercury. The latter, which is a violent poison, makes an excellent wash for wooden or any absorbent floors in a solution of 1 in 3,000. All lees and refuse should be carried to a considerable distance from the cellar, and not thrown just outside the door as is often the case. If special stress be laid upon the necessity for absolute cleanliness, it is from the palpable neglect of it so unfortunately apparent.

MILK FEVER AND OTHER CALVING TROUBLES.

By J. R. Weir.

Introduction.

Under the somewhat vague expression of milk fever, many people include all the ailments to which cows are subject at and after calving, and losses sustained by owners at such period are attributed to this cause. It matters little whether it be parturient apoplexy, metritis, or general debility, the one term is used to cover the whole. This is unfortunate and misleading as in reality the number of cases of true parturient apoplexy or milk fever are not great, although from reasons which will be seen presently their number may be on the increase. Cases of metritis are fairly common, but the conditions favouring this complaint are in no way similar to those of milk fever. The same remark applies to general debility, the losses from which in some seasons are very great, more especially when the cows have been milked on late in the summer, and a dry autumn has been succeeded by a hard winter, and they have been grazing on lands where the grass was very scarce, and wanting in shelter. Heifers, if in low condition, are especially subject to be thus affected in such circumstances, and the more so if they are but just over two years old when they should have been in better pasture, or, failing that, been fed and had sufficient shelter. Again, soil wants are an important factor in predisposing animals to an attack of debility at the time of calving. Even though there is a seeming abundance of grass, it may be deficient in constituents requisite to build up and support not only the animal itself but also the foetus in the uterus, which acts as a drain on the vitality of the dam. Each succeeding year these deficiencies will become more and more pronounced unless made good by artificial means, through manures rich in what such lands lack.

Milk Fever.

Parturient apoplexy, milk fever, dropping after calving, is a disease peculiar to the cow, occurring within from four hours to five days after calving and rarely before the third calving, never before the second calf. It is to be noted that it is most frequent after parturition has been easy and the after-birth has come away freely, attacking the rich heavy milkers much more frequently than animals yielding a quantity of milk poor in quality. Animals once attacked with milk fever are subject to a recurrence, hence it behoves owners, when an animal has once been attacked and survived, not to risk the chance of another calving but fatten her off for the butcher.

Symptoms.

Shortly after calving, generally in a few hours, the cow becomes restless, raises its hind feet alternately, the breathing seems quickened, exhibits no desire to move and when forced to do staggers in its gait. Appetite and rumination (*i.e.*, chewing the cud) cease, the eye has a staring vacant expression, the ears droop and the head hangs down, and lactation at once fails. In less than 24 hours the animal falls, the hind limbs seeming weakened and give way, it is unable to rise although it may possibly make several attemps to do so. It will be found on examination that the eyes are bloodshot and insensible to the touch, and the animal seems to have lost all sensation and power of voluntary motion. The pulse is full, soft, and often slow, later it becomes faster, smaller, and finally imperceptible. The breathing efforts, at first somewhat quick, become slow and deep, and a snorting sound is emitted with each respiratory movement. Saliva dribbles from the mouth and there is inability to swallow. The animal may be pinched or pricked, and exhibit no sign of feeling. The head and horns are hot, and the cow exhibit every symptom of paralysis. Although it may lie on its side throughout the attack, it generally lies on its belly, with the head drawn round towards the flank and resting on the ground, and if the head is put straight it appears insensibly to turn round to that position. This is by some authorities considered "due to special tonic spasm of the cervical muscles." The udder remains soft and loose, or it may become hard and small. The visible mucous membranes become purple in colour, and the muscles of the eyes exhibit twitching movements. The cow, being in a comatose state, seems in a deep sleep from which she is with difficulty aroused. Rumination being suspended, the retention of food in the stomach is conducive to fermentation in consequence of which the belly becomes distended and enlarged by gaseous matter, hence the breathing becomes embarrassed by the encroachment of the inflated stomach on the chest. Eructations and escape of gas are loud and frequent, and sometimes portions of the solid and fluid contents of the paunch are forced into the mouth, from whence it may gravitate into the lungs and cause suffocation. The animal being unconscious and the bladder being in a paralysed condition, the urine should be removed by artificial means. The animal is unable to swallow, and fluids poured into the mouth find their way into the windpipe exciting inflammation and hasten the end.

Treatment.

First prop the animal up in a natural position with the assistance of bags of straw. Rub the spine briskly, as also the limbs, with a brush. Bathe the head freely with cold water. Administer an enema of sulphate of magnesia and bicarbonate of soda. Cover the spine with a warm rug, as all portions of the body with the exception of the head will be found cold. Before administering the enema it is advisable to raise the hind quarters slightly, and in the absence of a clyster pipe or syringe a bullock's horn well greased may be used. Prior to this all hardened faeces should be removed by the hand from

the rectum. Two quarts at a time will suffice for an enema at a temperature of not more than 100 degrees Fahr. Remove any milk which may be in the teats, and having washed the udder first with soap and lukewarm water and afterwards with a 2 per cent. solution of lysol, inject the following in equal portions into each quarter of the udder, kneading it vigorously to allow of the equal distribution of the fluid throughout the gland :—

Iodide of potassium	... ...	2 drachms
Boiling water	... ...	1 quart.

Dissolve the iodide of potassium in the boiling water, and when it has cooled to 100 degrees Fahr., with an Arnold's milk fever syringe inject one quarter of the mixture into each quarter of the udder. Before placing the nozzle of the syringe into the passage of the teat it should have been inserted into a 2 per cent. solution of lysol in order to disinfect it. If necessary, repeat the injection in six hours. It may be mentioned in passing, this treatment is known as the Schmidt-Kolding, and its efficacy has been amply demonstrated in such portions of the world where it has been tried. With each syringe full directions as to usage are issued and the operation is a simple one, all that is necessary being not to push the nozzle into the lumen (passage) of the teat roughly, nor attempt to force the fluid too rapidly into the udder. The rapidity with which nature reasserts itself after the injection of the iodide is in every case marvellous. Strip the udder frequently and do not drench.

Cause.

Many predisposing causes have been cited by various authorities, but that of Yucker is, I think, the most probable. He attributes milk fever to the development of a toxalbumin in the udder, a view further shared by many other authorities. Lower organisms, he says, still unrecognised and unknown may gain access to the udder by the teat passage or lumen and set up decomposition of the colostrum (first milk in the udder after calving). Upon these organisms iodide of potassium acts as it does upon actinomyces in a specific fashion. A certain quantity of the salt will be absorbed, and this may neutralize that portion of the toxin that has already gained the circulation. This last explanation may be offered for the rapid disappearance of the grave symptoms established through paralysis of the pneumogastric nerve, due to the action of the toxin upon the nucleus of origin of the nerve within the medulla oblongata.

Others attribute the disease to accumulation of milk producing elements in the blood giving rise to fever, to sudden overloading of the system with blood causing nervous disorder. In support of this latter theory it is alleged that as milk fever invariably succeeds easy parturition a large excess of blood is thrown upon the system ; either some excretory organ exerts its powers of action (vicarious) or there is a sudden increase in blood pressure and congestion and apoplectic lesions take place. Normally the mammary gland becomes very active and removes the excess of nutritive blood constituents, while watery matters are also removed by the organs of excretion.

Post Mortem Appearances.

The blood, dark in colour and distending the veins, shows the presence of fatty emboli, *i.e.*, has drops of yellow oily matter floating on it. Congestion of the brain and spinal cord with apoplectic clots on various parts is noticeable. There is no other evidence to guide one in determining specifically the nature of the ailment.

Prevention.

As this at any time is better and easier than cure, it would be well for owners of valuable dairy cows to bear in mind this condition may be prevented. As before stated it does not attack heifers, only cows that have had at least two calves, rarely occurring even at that time but only at later periods. We have further seen that those animals whose milk contains the greatest amount of butter fat are the most prone to it, and with the propagation of animals in which this is the chief aim, it follows that there will be a greater tendency for the disease to become more common in future than in years gone by, when this essential was not brought out in such a marked degree as at present. With an animal capable of such possibilities, it is only fair to presume that its owner will endeavour to take from such an animal as much as he can, consequently he will endeavour to stimulate these qualities by choicer foods and more care and attention in order to obtain as high results as possible. But herein may be the source of trouble, he may be too lavish in his care by not milking her for a long period after she becomes in calf. Or on the other hand she may be placed in too luxuriant pasture, when the animal will have to bestir itself but little to provide a feed, in consequence of which it does not take sufficient exercise. From this I do not wish it to be inferred that none but fat cows get milk fever, but as a general rule fat ones are more subject to it than poor ones, and the following simple and easily carried out suggestions will prove serviceable in preventing cows from contracting milk fever.

(1) Part with your old cows, fatten them up and let them pass into the hands of the butcher.

(2) Milk late on after they become in calf.

(3) Turn them on to pasture where they will have to walk about and take exercise by hunting for their food.

(4) Give a dose of opening medicine before calving.

(5) If necessary, before calving milk morning and evening. This will tend to reduce the pressure of the colostrum in the udder, and lessen its chances of decomposition by affording a resting ground therein for micro-organisms which may be present in the teat, and but await a suitable medium for development.

(6) Do not allow cows heavy in calf to be driven too rapidly, or chased by dogs, as this is a prolific cause of mischief.

By carrying out these suggestions which are practicable, it will be found the risk of milk fever will be minimized if not averted. I

have found that milk fever is more prevalent in late spring and summer than at other times of the year, hence will be seen the necessity for giving the drench a few days before calving, so as to rid the system of deleterious matter as well as cool the blood.

The following will be found a serviceable drench for this purpose :—

Epsom salts	1 lb.
Iodide of potassium	2 drachms
Treacle	4 ounces
Water	1 quart

Dissolve the iodide of potassium in a quart of boiling water, then add the Epsom salts ; stir well to ensure their being dissolved, add the treacle, and when the mixture has cooled to about 100 degrees Fahr. give as a drench to each animal.

It might be well to add, the Arnold's milk fever syringe may be procured from any wholesale druggist, as also from several firms who make a specialty of importing and stocking veterinary instruments. This, with a catheter and clyster pipe, should be in the hands of every stock owner. A good substitute for a clyster pipe and one with an easy flow is made with a kerosene tin having a few feet of rubber piping attached to the centre of the bottom of the tin. This can be hung up over the animal at any desired place, and can be in the hands of all, its cost being but little, and is easily replaced at any time.

Metritis, Metro-peritonitis or Puerperal Peritonitis.

I will now pass on to the consideration of this affection, which is too often confounded with parturient apoplexy but is in no way identical with it.

Cause.

As milk fever is too often brought about by too great care on the part of the owner for his animal, so this disease is brought on by hardship or accident sustained. The principal causes are the following :—The retention of the after-birth or of the foetus, through which the peritoneum becomes involved ; the uterus or vagina becoming torn during parturition, more often when mechanical assistance has been rendered ; inversion of the uterus ; exposure to cold wet weather during the period of labour ; overdriving, especially of very fat cows or of weak young heifers.

Symptoms.

There is every appearance of the animal being in severe pain, fever, and the pulse is peculiarly hard and quick. The breathing as the disease progresses becomes quickened, frequent, and often as if from the throat only. The cow strains, the vulva emits a chocolate colored fluid, and the lining membrane of the bearing is of a dark purple color, the labiae (lips) being small and the vicinity is swollen.

The milk supply ceases suddenly, and the udder becomes soft and flabby. In latter stages the pulse becomes very rapid and imperceptible, the stomach distended with gas, and later the animal becomes comatose. There are usually signs that the animal is suffering acute abdominal pain. The animal rapidly becomes very weak, and death follows from syncope.

Post Mortem Appearances.

On examination the cavity of the uterus will be found to be small and to contain chocolate colored fluid, and the uterine walls are thickened. Blood extravasations are to be found beneath the peritoneum, which also exhibits various marks of inflammation. The veins of the uterus contain dark coagulated blood. On many of the serous membranes there will be found further evidence, as also on the inner surface of the labiae.

Differential Diagnosis.

From the foregoing account it will be easy to determine the difference between this disease and milk fever. The former follows difficult parturition with possibly retention of the after-birth, the latter, on the contrary, is but the sequel to an easy calving and voidance of after-birth. Metro-peritonitis is slower in its action and unaccompanied by paralysis. Drenches may be given to an animal suffering from the former, but to drench a cow suffering from milk fever would simply mean suffocation. Although the animal eventually becomes comatose still this rarely happens before three or four days, whereas with milk fever it is almost immediate.

Treatment.

Isolate the animal from other cows, more especially those which are in calf. Syringe out the uterus with a 1 per cent. solution of creolin or lysol, or a 1 in 1,000 of corrosive sublimate. Remove with the hand all after-birth. Keep bowels open with half doses of laxative medicines, and the condition being septic, creolin in drachm doses with warm gruel frequently. Keep up the strength of the animal with strengthening easily digested foods. Thoroughly disinfect with quicklime all excreta or discharges from an animal thus affected. If necessary, remove the urine with a catheter.

Debility.

Under this heading will be embraced most of the trouble to which cows in this State are subject at the time of calving. A broad and clearly differentiating line has been shown to exist between milk fever and metro-peritonitis, both from different conditions during the progress of these diseases, as also from the fact that milk fever attacks only animals which have borne calves previously, whereas metro-peritonitis may supervene on parturition with the first calf. For general purposes in treating with debility, reference will be made only to the conditions under which cows are kept in this State. In many parts, where sufficient care is not taken to prevent the bull

serving very young animals, they get in calf much sooner than their owners would like. Too often these young heifers are grazing on scant pastures, semi-exhausted cultivation paddocks upon which there is not a semblance of shelter to keep rain or cold wind from them. Is it to be wondered then that such an animal, half-starved as it is, is unable to endure the double strain imposed upon it, of building up its own constitution and supporting the foetus, and should at the calving experience great difficulty in pulling through debilitated as it must necessarily be. If able to pass the calf unaided, there is still danger of the foetal membranes remaining in the uterus, inducing metro-peritonitis if no care is taken of it. The same remark applies to cows which have passed through their first calving safely, and have either been milked too long or their strength has not been maintained by proper food and nourishment. Even though they pass the calf safely they are unable to clean without assistance, with the result that retention of the after-birth sets up trouble.

In treating with this condition, it is to be borne in mind the first thing necessary is to keep up the animal's strength. For this purpose warm gruel, to which has been added an ounce of ground ginger and half a pound of malt extract, may be given. Clothe the animal well with rugs so as to keep as much cold from the patient as possible. Keep the bowels open with a mild laxative. Irrigate the uterus freely with the antiseptics previously mentioned, and if necessary remove gently the after-birth, or such portions of it as can be reached freely by manual exploration. Should the placenta show no signs of passing off, give drachm doses occasionally of ergot. Where easily procurable, great benefit will be derived from the administration of ale or good wine when the animal is in a weak state and unable to get up. Attention to these matters will prevent an attack of metro-peritonitis and perhaps be the means of saving the life of the animal.

Conclusion.

Before closing this brief paper, attention should be drawn to the fact that when a cow is down with any of these ailments the animal should be repeatedly turned from side to side and the limbs freely rubbed. Considerable benefit may be obtained by fomentations of hot water over the loins, but it must be remembered that every precaution must be adopted to prevent the animal catching cold in that region. Before manual exploration of the rectum or vagina, the hand and arm should be well washed with water as hot as can be borne, it should then be well smeared with carbolic oil or immersed in a 2 per cent. solution of lysol. Great care should be taken that the nails are cut short as wounds may be inflicted by them on the vagina or rectum. Often the bladder may be relieved by gentle manipulation of the neck of the bladder, and, by introducing the finger into the point of the neck at the same time giving the hand a half-turn over, the urine will be released from that organ.

When the life of a valuable dairy cow is at stake, owners should lose no time in calling in the services of a qualified veterinary

practitioner as these hints are not to be taken in any way to supplant their professional advice, but rather to assist those persons who are far remote from such assistance, and as the animal has only a certain value the cost of such assistance would swallow up its value. To such as these latter these suggestions are given as the outcome of practical experience.

I have to acknowledge my obligations to the pages of the *Veterinarian,* as also to Steele's *Bovine Pathology,* for the hints contained in reference to the probable pathological conditions preceding an attack of milk fever.

BUILDING UP A DAIRY HERD.

By A. Kyle.

In travelling through some of our dairying districts one is struck with the miserable, shapeless cows the average dairyman is breeding, which is due to the fact that any sort of a bull is used in such herds. The bull is looked upon as a cheap machine to bring the cows in each year, and no thought is given to the building up of a herd of good looking, high test cows. High prices are freely given for cows, and whilst the average dairyman is prepared to pay £10 and £12 each for cows, a bull at £5 or £6 is considered quite good enough. There is no greater mistake made than this; let a man start his dairy with ordinary cows of good colour, and having a fair show for milk, and obtain a first-class bull from a good milking strain, and in a few years he will build up a dairy herd worth looking at. The cost of a good bull, say £60, appears to most men an enormous sum of money, and the bull running in the paddock and seemingly earning nothing, looks almost like a white elephant, but when the owner considers that every calf dropped on the place is affected by the bull, the £60 soon sinks into insignificance. A man with 60 cows will easily put 30s. per head value on the heifers he rears by using a first-class bull, and the first year's increase will, in all probability, return him his outlay. But it is later on that he reaps the greatest benefit, when the heifers by such a bull come into the bail, and he is getting a good flow of milk as well as a high test at the factory. The wonder is that dairymen who use a mongrel bull do not see the disadvantage they are labouring under, especially when they attend a clearing sale of cows and see them fetch to £20, only because their sire had breeding and quality in him. Where do we look for the successful dairyman? to the man who pays great attention to the selection of the bulls used in his herd. Some of the bulls we notice running with dairy herds are not fit to be at large, and the owners of such animals are generally pretty low down in the world, and always low down on the factory list. If the average dairyman of to-day wishes to compete with his more successful neighbours he must pay a great deal more attention to the selection of his bulls, and in a few years he will have a most valuable asset in the form of a herd of well bred, high test cows that will always command a high price.

THE YELLOWTAIL TOMTIT.

Acanthiza chrysorrhoa (Quoy and Gaim),

By C. French, F.L.S., F.E.S.

This little bird, so well known to every grower, orchardist and farmer, is a most valuable insect destroyer, killing out, as it does, vast numbers of insect pests, and is found in nearly every part of Victoria. It is a very sociable bird, inhabiting public parks and gardens near the city, building and rearing its young in the prickly acacia hedges *(A. armata)*, also in pine, Araucaria, Leptospermum and other trees. The nest is suspended, dome-shaped, with a small side entrance, outwardly composed of pieces of grass, cocoons of the so-called tarantula *(Vocconia)* and other spiders, pieces of rags, twigs of various plants, rootlets, &c., and lined inside with feathers, cotton-wool, and, in some instances, with rabbit fur and other soft substances. Many nests have a kind of dome-shaped opening on the top, in which the male bird is supposed to sleep whilst the female is sitting on the eggs. The small Cuckoo, the Bronze, often deposits its eggs in the Yellowtail's nest. The Yellowtail is an early breeder, nests and eggs having been observed by Mr. C. French, jun., as early as May in the Fawkner and other parks near the city. Nests are also frequently found attached underneath nests of the White-backed Crow Shrike (Magpie). On the Werribee plains, in the she-oak trees *(Casuarina)*, are many crows' nests and occasionally placed under these large stick nests, are nests of the Yellowtails, also nests of another valuable insectivorous bird, the White-faced Xerophila. The Yellowtail's eggs are mostly pure white, but sometimes have a few light reddish spots, in some instances almost forming a zone, not unlike the markings on eggs of the Blue Wren or Superb Warbler. Eggs, usually three or four for a sitting. According to Mr. A. J. Campbell, this species of *Acanthiza* is also found in Queensland, New South Wales, South and West Australia, and Tasmania.

Gould states in his work "*The Birds of Australia*," vol. 1., page 375, that the sexes are alike in plumage, and may be thus described :—

"Forehead black, with a spot of white at the tip of each feather; cheek, throat, and a line from the nostrils over each eye, greyish white; chest and under surface yellowish white, passing into light olive-brown on the flanks; upper surface and wings, olive-brown; rump and upper tail coverts, bright citron-yellow; base of the tail feather white, tinged with yellow; the external margin of the outer feathers, and the tips of all, brownish-grey, the central portion, blackish-brown; bill and feet, blackish-brown; irides, very light grey."

YELLOW-RUMPED ACANTHIZA.

Acanthiza chrysorrhoa.

LIVER ROT OR FLUKE.

By A. A. Brown, M.B., B.Ch.

Introduction.

The disease called "Rot" in sheep has been known from time immemorial, and has been the cause of extensive mortalities in flocks all the world over. It is dependent upon the presence in the livers of flukes in excess. Flukes are said to have been introduced into this State in 1855 by German imported rams. In wet seasons—and more particularly after a succession of wet seasons—the number of sheep that perish from rot is astounding. In Victoria deaths from outbreaks of rot may commence to occur about March and persist till the end of September. In comparatively dry seasons mortalities are slight. In March young flukes commence to invade the liver in enormous numbers, clogging the bile ducts. It has been ordained by Nature that the flukes that devastate flocks should inhabit the bile ducts of the liver of sheep. Flukes if present in small numbers in the liver do no harm, but rather may be of benefit to the animal they infest. They act, when few in number, as hepatic stimulants, and thus they stimulate the flow of bile and lead to improvement in condition of the animal. I have seen in my experience a great many sheep slaughtered that had a few flukes in the livers and that were in prime condition at time of slaughter. It must not, however, be concluded from this that flukes are essential to the well-being of sheep. It is the excess of the parasites that gives rise to rot, not their mere presence. It is now almost certain that flukes last but one season in the liver, but an animal may get re-infested from the pastures over which it roams. Many animals harbor flukes in their livers—horses, cattle, pigs, goats, hares, rabbits, kangaroos, &c., and I have seen the *Distoma hepaticum* in the liver of a shark. In the liver of man in Egypt sojourns a fluke, the *Bilharzia haematobia.* Flukes frequent, with but few exceptions, all classes of the animal kingdom (mammals, birds, fishes). The higher classes of animals become infested through the intermediation of molluscs, worms and crustaceans, and it is in the bodies of these creatures that the first stages of the existence of flukes that can invade the higher animals obtain their abode.

(To be continued).

THE ORCHARD.

By Jas. Lang.

Cultivation.

A great variety of work requires attending to during this month, and ploughing, harrowing and scarifying will occupy a good deal of time in order to get the land into good condition and free from weeds. This work should not be delayed, as the ground soon sets hard, and makes it almost impossible to do a good job. This is all the more necessary where young orchards have been planted, as keeping the ground constantly stirred and free from weeds contributes more than any other operation to the successful growth of the young trees. Look carefully over the young trees and remove all unnecessary shoots, leaving only those required to form the tree.

Spraying.

Spraying for the black spot on the apple and pear with Bordeaux mixture requires early attention, the strength 6—4—40 is recommended by the Pathologist's branch to be used.

In the moist districts to the east of Melbourne, extra vigilance will have to be given to the matter, the past summer being unusually moist developed the disease to an abnormal extent. The first spraying should be given when the bloom buds are just bursting and another when the young fruit has grown about the size of small walnuts; should the season prove moist further sprayings will be required at intervals of about a fortnight or three weeks.* Instructions as to the best method of mixing the Bordeaux have been given in previous numbers of this *Journal.* Some orchardists who have a difficulty in procuring fresh lime will be glad to know that lime in air-tight tins will keep fresh for several months. The plan adopted by the writer last year was to fill kerosene tins with the fresh lumps of lime and close down by pasting brown paper over the aperture, and when a tin was opened later on the lime was as fresh as when put in the tin. Apricots also will require spraying with Bordeaux for shot-hole and scab; a good time to spray is when the trees have just gone off the bloom, and another spraying about three weeks later.

Spraying for the codlin moth will also have to be attended to, the first spraying should be given when the petals have dropped from the blossoms, and before the calyx closes up. Another spraying should be given in about four weeks time, and afterwards at fortnightly intervals right through the summer. The moth generally makes its appearance about the early part of October, and it takes about three months before the first brood are all hatched out. Trees should also be bandaged, and looked over at intervals of ten or fourteen days throughout the summer, this helps to keep down the numbers of the second brood very considerably.

Look over all trees newly grafted and in the case of old trees the scions will have to be secured to a stay to prevent the wind blowing them off.

*In Bulletin 17 just issued, the Vegetable Pathologist recommends only two sprayings at the most, the first as the buds are bursting and the second just as the fruit has set. [Ed. *Journal.*]

GARDEN NOTES.

By J. Cronin.

Flower Garden.

Many herbaceous, shrubby and bulbous plants that bloom during the autumn months may be planted in November and December including Dahlias, Salvias, Delphiniums, Gladioli, etc.

If Chrysanthemums have not yet been planted into their flowering quarters such planting should be done at once. Plants from pots may be safely put out any time during November; cloudy or showery days being most suitable for the purpose. If the soil has been well worked and manured, as previously advised in these notes, good results may be reasonably expected. When specially fine blooms are desired, from three to six shoots should be selected after the plants break into lateral growth, each shoot being staked, and all other growths removed as they appear.

Dahlias may be planted as late as mid-January when young struck plants grown in pots are procurable. The best results are usually obtained in the metropolitan district from planting about New Year. In later districts, and where frosts are likely to occur during April, they should be planted a fortnight earlier. Dry tubers should be planted two or three weeks earlier than rooted plants from pots.

The Dahlia needs a free soil, liberally manured, the addition of charcoal, wood ashes, or rough litter being advisable if the soil is of a heavy close nature. The Cactus type is greatly to be preferred to the old show varieties, and is becoming more popular each season, owing to the many improved varieties that are being annually distributed.

Of Salvias, Bonfire is probably the best variety for mixed groups or borders, or for planting in masses, being of dwarf habit and producing in summer and autumn abundance of bright scarlet flowers. Bethelii, the flowers of which are rosy pink, tipped with white, growing to a height of four feet, is another kind worthy of general cultivation in mixed borders. *Salvia patens*, a dwarf growing herbaceous kind, is one of the finest blue flowering plants in existence.

Many of the recent hybrids of Gladioli are a decided improvement on the older garden varieties, and are probably the finest summer flowering bulbous plants. Childsii, Lemoinei, and the Butterfly sections are particularly fine. A batch of bulbs may be planted now for autumn blooming. The soil for Gladiolus should be deeply worked and manured, well decayed stable manure being the best.

Delphinium formosum and its hybrids, are beautiful herbaceous plants, producing long spikes of flowers of various shades of blue. They bloom freely during summer and autumn, requiring fairly rich soil, and water during dry weather. They should be planted at once.

Various bedding plants such as Alternanthera, Iresine, shrubby Begonias, etc., should also be planted as soon as possible.

Lotus peliorhynchus, a glaucous leaved trailing shrub, producing scarlet flowers, pea shaped, is a specially desirable plant for rock work or hanging baskets, etc. It is quite hardy, and rapid in growth, blooming profusely in early spring.

Where Roses are attacked by aphis, the plants should be thoroughly sprayed with a tobacco wash. "Nikoteen" is the best of the many preparations offered for sale, against insects of this class.

If mildew appears the plants should be thoroughly sprinkled with flowers of sulphur, early morning being the proper time for such application.

Shrubs attacked by scale insects should be thinned, and sprayed with resin compound.

Daffodils and other spring flowering bulbs that require to be lifted, should be so treated as soon as the tops have died off.

Kitchen Garden.

Young growing crops should be hoed and kept free from weeds. If this is not attended to, they will soon be smothered, and time, seed, and labor wasted.

French beans, peas, and seed of such vegetables as melons, squashes, etc., may be sown.

Advantage should be taken of showery weather, to plant out from previous sowings of cabbage, celery, etc. Carefully examine young cabbage plants for signs of club root, black leg, and other fungus diseases. Any so affected should be burned at once.

Lateral shoots should be pinched from tomato plants, and each plant securely staked. Should any insect or fungus then attack the plants they can easily be sprayed. Early tomatoes are almost invariably attacked by the larvæ of the tomato moth *(Heliothis)*. The plants should be sprayed on the first appearance of the grub, with Paris green, using one ounce of Paris green to 10 gallons of water. One pound of *new lump lime* must be slaked, and a quantity of water (about two gallons) poured over it. It should be thoroughly mixed, and strained into the spray pump or other vessel making up to 10 gallons. The Paris green should be mixed in a saucer or such vessel, in a small quantity of lime water and when thoroughly mixed, added to the 10 gallons of lime water. This should be thoroughly agitated while being applied. Do not use if the fruit is ripening.

THE ADULTERATION OF ARTIFICIAL FERTILIZERS.

By F. J. Howell, Ph. D.

The very large quantity of artificial fertilizers now used in Victoria, especially in the Northern wheat-growing areas, requires that every protection should be afforded by the Department of Agriculture against possible frauds. There is a wide spread opinion existing among the farmers that a large quantity of very inferior manure is distributed and sold each year by manure merchants. Although investigations seem to show that the plain superphosphates, generally, come up to the required standard, there is evidence that in a number of cases of bonedusts, nitro-superphosphates, &c., the articles do not reach the standard of quality guaranteed by the invoice certificate. With the object of securing information as to the quality, generally, of artificial fertilizers sold to farmers, and securing information as to whether the provisions of the Manure Act were being complied with in other directions, this office sent out a number of field officers throughout the State to collect samples for analysis, and to make inquiries in the direction specified. In addition to this, communications have been sent to all important Agricultural Societies asking for their co-operation with the department in protecting the farmer from fraud.

For the information of the farmer as to what has been done by the Agricultural Laboratory in this direction, copies of letters and reports, sent out to these societies, are reproduced in the *Journal* and are given below.

Agricultural Laboratory,
440 Lonsdale Street,
Melbourne, *10th August*, 1904.

The Secretary,
.....Agricultural Society.

Dear Sir,

I am forwarding you the results of the analysis of the manures gathered by my field officer in your district. I will kindly ask you to have this brought under the notice of your farmers and made public. I have had similar investigations carried out in other centres The failure to provide Invoice Certificates in so many cases has come as a surprise. It would have been advisable, if I had the officers for the work, to have collected the samples earlier in the season, as the manures with long keeping have lost some of their moisture, and this makes them somewhat higher in phosphoric acid than they would show with the original moisture. However if men are provided for me next year I hope to have samples collected early. Instructions have been given to prosecute vendors in your district failing to comply with the provisions of the Manure Act. These are all local men, and in order that all offending Melbourne firms should equally suffer, I should like to be informed of cases where the farmer has purchased direct from a Melbourne firm without receiving a Certificate. I am therefore sending you a number of forms which you might get filled in and signed by farmers. I am forwarding you a report of my investigations in all districts which field officers have visited. The matter is one which will interest farmers generally, and I would advise

an early publicity in your local press. The Department fully recognises the necessity of protecting the farmer from fraud in his purchase of artificial manures, and looks to the Agricultural Societies to assist in this direction.

I am, dear Sir, Yours faithfully,
FRED. J. HOWELL,
Chemist for Agriculture.

This is to certify that I have purchased.....tons of..... from.....at.....per ton, and that no Invoice Certificate showing the composition of the manure was delivered to me either before or at the time of purchase.

Dated at.....this.....day of.....1901.

Signature.....

Witness to Signature.....

Report sent to Agricultural Societies.

THE ANALYSIS OF MANURES.

The present Artificial Manures Act does not provide for the free analysis of manures for the farmer by the Agricultural Chemist. It makes provision, however, for the analysis of a manure from any purchaser on the payment of a fee of £1 1s. This provision has never yet been taken advantage of by the farmer. Having no means, therefore, through the initiative of the farmer himself to check any frauds which might be practised, this office considered it advisable to undertake the free analysis of manures and has willingly undertaken this work under certain conditions, both with samples sent in, and samples collected by its own officers.

THE WORK OF THE PRESENT YEAR.

Field officers, with the view of collecting samples, have visited the Geelong Brighton, Colac, Horsham, Minyip, Dunolly, Charlton and Boort centres. Eighty samples have been collected from these centres and analysed. Out of the total number collected invoice certificates from only 25 persons have been obtainable. A number of purchasers stated that a number of certificates had been given, but lost, others flatly refused to sign a form stating that no certificate had been given, but in 32 cases farmers who had received no certificate were willing to give their signature to that effect, and in all these cases I have asked that prosecution might take place. Failure to comply with the Manure Act was reported in the following places :—

7	cases at	Horsham
10	,, ...	Warracknabeal.
1	,, ...	Minyip.
3	,, ...	Wycheproof.
1	,, ...	Dunolly.
2	,, ...	Charlton.
7	,, ...	Geelong.
1	,, ...	Brighton.

SAMPLES SENT IN BY BODIES REPRESENTING FARMERS

In addition to the samples collected by my field officers, 18 samples were sent in by bodies representing farmers. These were made up of 4 samples from Nhill, 6 from Minyip, 3 from Warracknabeal, and 5 from Charlton. In offering to carry out the work without charge from these bodies, the request was made that invoice certificates should accompany the samples. Although there are various reasons justifying such a request, the principal of which was to obtain information as to whether certificates had been furnished, and prosecute in cases of non-compliance with the section of the Act prescribing it, the request in cases seems, from the statements of my field officers, to have been subjected to a very wrong intrepretation, an interpretation which I venture to think can only be confined to a very small section of the farming community.

PROPOSED LEGISLATION TO FURTHER PROTECT THE FARMER.

Under the present Manures Act, prosecution in case of fraud is left to the farmer. The farmer's dread of law, however, has, as far as I know, prevented a single action in a court of justice. The farmers of Victoria have, I believe, to thank Mr. Frank Madden for being the first to consider their interests in the matter of artificial fertilizers. He, I am informed, framed the present Act. Changed conditions, however, suggested to Mr. Pearson the advisability of certain amendments, and the Amending Bill at present before Parliament under instructions from The Hon. John Murray is his work, with the exception of certain additions made by myself, which the farmers have nearly everywhere represented as necessary for their better protection. These additions are:—

Prosecution, in case of fraud, by the Government.

The reduction to one-third of the original variation in analysis allowed by the old Act.

A label on every bag stating the chemical composition of the manure.

The present Bill, which is modelled largely on American legislation, makes it compulsory for every manure merchant, importer or manufacturer, to send in to the Agricultural Chemist, early in January of each year, samples of the manures he intends offering, together with the prices asked. The chemist is required to analyse these and draw up unit values. On the basis of these unit values all the manures offering are valued and the information is officially published for the information and guidance of intending purchasers. Provision is made to collect samples afterwards in the store and on the farm, with the object of discovering whether the material offered to the farmer corresponds to the article furnished the Agricultural Chemist. Should there be at any time a wish on the part of the farmer to confirm the results of the Agricultural Chemist by some independent authority, this can be done through official analysts appointed for the purpose outside the Department.

AN EXPLANATION OF UNIT VALUES.

It is very important the farmer should buy on analysis rather than on any particular brand or name of a manure, as there is no guarantee that this brand or name will not at times vary in quality. If, however, before purchase the farmer asks to be shown the analysis of the manure offered him, no mistake can be made. With a knowledge of unit values opinions can be readily formed as to whether a fair price is being asked or not. The unit value is the retail price of one per cent. of a particular fertilizing ingredient in a ton of manure as calculated from the average composition of the manures of that class offering and the prices asked. In the place of one per cent in a ton we can take one pound of the fertilizing ingredient as the unit and determine in the same way its market value. It is a standard to which all manures of that class can be referred for comparative valuation. The unit values are determined by the Agricultural Chemist. As the superphosphate is principally used we will deal only with this class of manure. The ingredient of fertilizing value in a superphosphate is phosphoric acid, and this ingredient exists in three forms—the water soluble, citrate soluble and insoluble. Suppose calculation gave as the average cost on the market of one per cent. of water soluble phosphoric, the figure 5/6, this would be regarded as the unit value of water soluble phosphoric acid, and so on for the other forms. Following out this system we assigned last year the following unit values:—

Phosphoric acid, water soluble, 5/3
,, ,, citrate ,, 4/6

As the small amount of insoluble in a superphosphate can not be regarded as playing an important part in fertilization, no value need be assigned or at least no appreciable value. The question then for the farmer is to find the approximate commercial value of the superphosphate he intends buying, analyzing a stated percentage of these two forms. He does this by taking the number of units of the manurial elements in the two forms it contains and multiplying by the market value per unit of such element.

Suppose there are three different superphosphates offered him by three firms:—

The first	analysing	18% Water soluble phosphoric acid 1% Citrate ,, ,, ,,
The second	,,	16% Water soluble phosphoric acid 2% Citrate ,, ,, ,,
The third	,,	15% Water soluble phosphoric acid 1% Citrate ,, ,, ,,

As we know the unit values of the two forms (the value of 1 per cent. in a ton), it is easy to calculate the full value of a ton of each of the manures :—

		Value of Manure.		Price asked.
Thus the first	.. 18 × 5s. 3d. =	£4 14 6		
	1 × 4s. 6d. =	4 6		
		£4 19 0	..	£5 0 0
the second	.. 16 × 5s. 3d. =	£4 4 0		
	2 × 4s. 6d. =	9 0		
		£4 13 0	..	£4 15 0
the third	.. 15 × 5s. 3d. =	£3 18 9		
	1 × 4s. 6d. =	4 6		
		£4 3 3	..	£4 15 0

In the first two cases it will be seen that the price asked and the valuation show no very marked difference. In the third case, however, the price is far too high for the fertilizing ingredients contained in the manure, and the use of the unit values enables the farmer to find this out.

FRED. JNO. HOWELL,
Chemist for Agriculture, &c.

EXPERIMENTS IN FRUIT MANURING.*

By F. J. Howell Ph. D.

The statement that we possess far less data in connection with fruit manuring in Victoria than we do with regard to other staple crops cannot be used as a reproach to the Department. The trouble, time, and accurate methods required in investigations of this nature, as compared with the work entailed in the less difficult and less lengthy experiments carried out on other farm crops, have up to the present prevented any satisfactory scheme of co-operation between the grower and the Department. The great obstacle has, I think, been the demand on the part of the Department for the gratuitous services of men who could not afford it, and who in the absence of immediate results of advantage regarded such services as an unremunerative sacrifice. Elaborate plans have at times been prepared by this office embracing a comprehensive series of tests for the orchard. Manures have been carefully weighed, mixed and bagged, and detailed instructions sent out for their proper distribution. But the apparent absence of results and the contradictory nature of returns have indicated either an absolute failure in operative effect on the part of manures, or raised suspicions that the great work entailed in the separate harvesting and weighings had interfered with the proper carrying out of all operations.

Do Manures produce an Effect?

Testimony to the effect produced by manures in the orchard is so general that we must regard the belief as resting on solid foundations. Should this be the case, there is nothing to prevent experiments carried out on a proper system resulting in valuable and instructive data. The word manures takes in a very wide range of different fertilizing materials. It is not enough to say that manures act. We require to know how each particular fertilizing ingredient in its various forms operates, and the extent to which it may be required and is operative on our different kinds and classes of fruits. Chemical analysis reveals a wide divergence in the composition of our different fruits, and although the assumption that on this basis alone manure formulæ may be drawn up is an extreme view of the case since other considerations come in, still these great differences in the composition of the different fruits indicate the wide scope of experiment which must be undertaken before we can express definite opinions on the manurial requirements of the orchard.

*A paper prepared by me and read by Mr. F. E. Lee at the conclusion of his lecture before the Victorian Fruitgrowers' Central Association.

The Establishment of Experimental Fields.

To secure reliability of results in the experimental manuring of fruit trees on the many different kinds of soil, numerous points require to be seriously considered. Owing to the great individual differences in the trees themselves, the number included in each plot should be as large as possible. The ground must be of a uniform character both in soil and subsoil, and to offer facts of wide applicability should be typical of the great bulk of land in the district. It should in no part suffer from defective drainage conditions. The trees naturally require to be of the same variety, of the same age, and as uniform in growth as possible. The same system of pruning must be adopted right through the field, and a uniform system of treatment prevail throughout. Under such conditions results of reliability might be obtained. But operative effects will, judging by my observations, not follow the first year, probably not the second year, and may only assume definiteness allowing of the expression of opinions at a period even beyond this time. I should not advocate the Government co-operating in investigations of this kind without some guarantee on the part of the grower that the work would continue over at least six years. I do not even then believe that a marked effect will be observable in orchards in early bearing except on the poorest soils. The root range of the tree is so great that for many years manures will not, I think, be regarded as a pressing necessity on a wide range of soils. Successive crops over a number of years naturally suggest other possibilities. These remarks apply only to actual yields. But the quality of the fruit, its period of ripening, the resistant power of the tree to disease, and other matters may perhaps be regarded as showing a more immediate influence to the action of manures than the actual yielding capacity. In my opinion field experiment and laboratory investigation should go hand in hand in work of this kind. The soils and subsoils of experimental areas should be analysed both chemically and mechanically. Information on the adaptabilities of these and similar areas for different kinds of fruit, or different varieties of the one kind might be gathered, rainfall and temperature conditions recorded, fruits analysed, and a mass of facts elaborated and tabulated which might serve as a basis for the specialization of crops and a valuable guide for prospective growers.

The Cost of Such Work.

Such work would naturally involve a certain expenditure, but if you as a body are seized with the importance of these investigations it is for you, and not for me, to ask that provision should be made for the expenditure. I should be acting dishonestly if I were to pretend I could give definite advice as to the manurial treatment of your orchards. It is a mistaken view to think in our present state of knowledge a chemical analysis alone of the soil will enable us to do this. We must get answers first from the plant. Data permitting of the expression of such opinions must be first obtained by actual

experiment. It is such experiments which have solved similar problems for the wheat grower in the north and the hay grower in the south. By the introduction of such a system in the orchards of the State there is no doubt that the many problems of this nature confronting the fruit grower would find an early solution. In every fruit growing centre there is a prevailing type of soil with perhaps variations over limited areas. My advice would be to have properly established experimental fields on each of these types, with provision for carrying out under expert departmental supervision all important operations in connection with the investigations. The fruit growing industry is already a large one. With improved methods for the profitable utilization of all supplies in excess of local demands, it must in the future become a much larger one, and it seems to me reasonable to suggest that the same monetary assistance should be given to further the interests of the fruitgrower as has been provided for the farmer in the narrower sense of the word.

NATIVE OR BLACKFELLOWS' BREAD.

By D. McAlpine.

At various times specimens of the so-called native bread have been sent to me with requests for information as to its nature and uses, and it seemed desirable to bring together for the benefit of readers of the *Journal*, the main facts known at present concerning it. And this is all the more necessary since the most extraordinary views are put forward by some as to what it really is, the imagination being allowed free play in accounting for it, and statements have been made without steps being taken to test their accuracy. Strange and mysterious are the terms often applied to it, and yet when its growth is followed like that of any other organism, with the aid of a scientific use of the imagination, its life-history is found to be comparatively well known. Being underground and often of a large size, it naturally excited wonder when turned up by the plough or in other ways, and although its fungus nature has long been known, it is only within recent years that light has been thrown on the particular form it assumes when it has reached its full development.

It has been regarded as of the nature of a gall, and even as the root of some flowering plant, but it is most commonly considered as akin to a truffle from its underground habit. Even among scientific men the latter was the prevailing view at first, but all these guesses have now been proved to be wrong, and the discovery of the fructification allows it to be characterized as definitely as any other plant. It is purely an Australian production and from its scientific interest, as well as its use by the aborigines, deserves our careful consideration.

History.

The earliest account of this vegetable growth was given just seventy years ago in 1834 when Mr. Backhouse described it in a notice on the esculent plants of Van Diemen's Land. At that time very little was known about it, and since the remarks are of historic interest and have been often referred to, they may be given in full. He writes:—"This species of tuber is often found in the Colony, attaining to the size of a child's head; its taste somewhat resembles boiled rice. Like the heart of the tree fern and the root of the native potato *(Gastrodia sesamoides)* cookery produces little change in its character. On asking the aborigines how they found the native bread, they universally replied, 'A rotten tree.' On the dry open hills about Bothwell it is to be detected in the early part of summer, by the ground bursting upwards as if with something swelling under it, which is this fungus." The reference to a rotten tree evidently meant that it was found in the vicinity, but subsequent writers on quoting this, fell into the error of supposing that it either grew on or

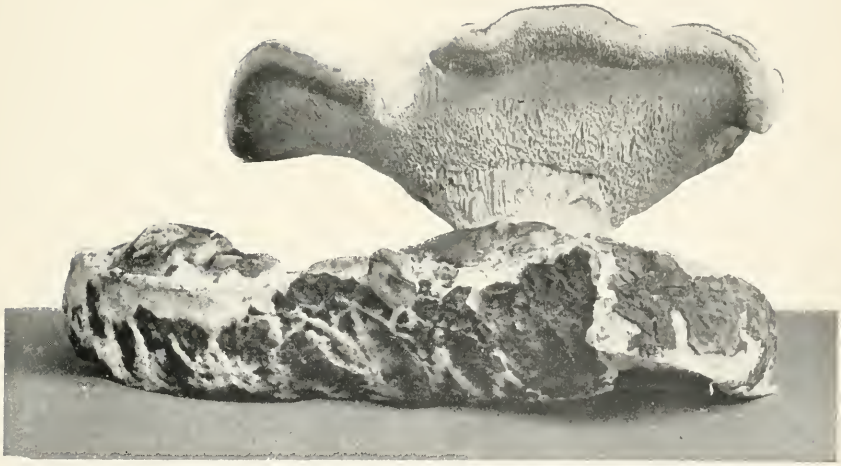


FIG. 1.—SLICE OF NATIVE BREAD WITH FRUCTIFICATION.
(*Polyporus mylittæ, C. and M.*)

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in rotten trunks and have described it accordingly. From specimens sent to England by Messrs. Lawrence and Gunn, it was scientifically named and described by Berkeley in 1839 as *Mylitta australis* and since its true position could not be determined in the absence of fructification, specimens were afterwards being constantly examined by scientific men, in the hope of finding some clue to its real nature. In 1848, Mr. Berkeley came to the conclusion that it was allied to the truffles, and in 1851 it was examined by the brothers Tulasne, who saw in the cells of which it was composed some resemblance to those of a *Polyporus* and also to those of a truffle.

About forty years later in 1890, Cohn and Schroeter investigated these and similar tuber-like underground growths, and Dr. Fischer in 1891 examined a specimen sent to him by the late Baron Von Mueller, but no further advance was made in our knowledge until 1892, when the fructification was, for the first time, described by Dr. Cooke and the fungus named *Polyporus mylitta.*

There is another *Polyporus (P. tuberaster)* which is associated with a firm sclerotium-like structure and which was also supposed to be a sort of truffle, but it turns out to be simply a strongly developed mycelium traversing balls of earth, which it has the property of collecting together in a compact form. It is grown especially in Italy, on account of its edible qualities where it is known as *Pietra fungoja* (fungus stone).

Nature of the Fungus—A Sclerotium.

The native bread is found buried in the ground like a potato, and does not, as far as I have seen, give any surface indication of its occurrence, although, when growing rapidly, it is said to crack the ground above it. It is usually met with in ploughing, grubbing trees, or cutting roads, and may be a few inches or several feet from the surface. It is generally somewhat round or oval in shape when fresh, but it may become wrinkled and irregular on drying. Occasionally it may assume a comparatively slender elongated form as in Fig. 4 *a*, *b*, and I am indebted for these specimens to my colleague, Mr. French, who obtained them at Emerald. It varies in colour from brownish to blackish, and is found from the size of a pea or hazel nut to that of a man's head. The weight is likewise variable, but a specimen weighing 39 lbs. was sent by the late Mr. A. P. Miller, of Tasmania, to the British Pharmaceutical Conference in 1884. Even heavier specimens have been known according to the late R. Brough Smyth, who writes, in his work on the Aborigines of Victoria, as follows :—" The Native Truffle (*Mylitta australis)* a subterranean fungus was much sought after by the natives; when cut it is in appearance somewhat like brown bread. I have seen large pieces weighing several pounds, and in some localities, occasionally the fungus weighing 50 lbs. is found." At Emerald, where specimens are very common, I weighed one of the largest, and found it 19 lbs., Fig. 5*a*, although it had been three months out of the soil, and so allowed to harden and dry up. The soil here is volcanic and dark chocolate,

and they are most numerous in the best ground, while very scarce in the poor soil. I met with some instances where the native bread had become curved on one side from growing round a decaying root, in other cases it had completely enveloped the rhizome of a bracken fern. Among the solid specimens there are others in a more or less decomposed state, and it would appear that this decay may take place very quickly. When cut across in the fresh state it has something of the consistency of cheese or stiff gelatine, but on exposure to the air it soon becomes hard and horny. While the outer surface is dark, and may peel off in flakes, or even form a sort of rind, the inner substance is yellowish-white, and marbled throughout with chalky-white lines, which give it an irregular honeycombed appearance. So far there is nothing to indicate the true nature of the structure. but if a small portion of this whitish substance is teased out and examined under the microscope, it is seen to consist of a tangled mass of branching filaments, just like the spawn of a mushroom. It is, in fact, a compact mass of fungus tissue, and when the fungus threads become closely wound and dense, so that the outer layer of threads turn brown or black and hard, while the inner remain whitish and comparatively soft, such a body is known as a *Sclerotium*, from the Greek word meaning hard. It is a form of the fungus in which it stores up as much nutriment as possible in its mycelial threads to enable it to withstand the varied changes of climate, the hard outer coat protecting the dormant inner portion until suitable conditions arise for its further development. There are numerous similar cases known, however, only the sclerotia do not attain such a size, and, perhaps, the ergot of rye is the most familiar example. In the truffle, to which this form was long supposed to be allied, there is nothing in common but the underground habit, and the edible properties which, however, are too superior to be strictly comparable. In the inner tissue of the truffle there are reproductive bodies in the form of little bags containing spores, which separate it at once from this form.

Edible Qualities.

When one sees this fungus, as is frequently the case, in the hard and dried up condition which it assumes with age, there is little to suggest that it might be used for food. It has then a dark brown wrinkled skin, which may peel off in flakes, and the white substance enclosed is so excessively hard that, like the cheese in Tartary, it requires an axe to cut it. But when fresh and soft it is somewhat of the consistency of cheese, and looks more appetising. I have several times had an opportunity of testing its edible qualities, having found fresh specimens exposed in road-cuttings or having them sent to me while still soft.

In the raw state it reminds one of rice or tapioca, and has a decided flavor of cocoanut; although it loses this with age. When toasted like a piece of bread it is not unlike passover cake to the taste, and when boiled it becomes tough. I consider it rather insipid, no matter how prepared, and not at all appetising. There is no

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FIG. 2.—NATIVE BREAD WITH FRUCTIFICATION.—OUTER VIEW.

starch formed, as may easily be proved by applying the tincture of iodine, which does not give the well-known violet reaction.

The name of native bread, first given to it, is apt to mislead, for Tulasne, the distinguished mycologist, in describing it, in 1851, remarks that "it is the native bread of the English colonists of Tasmania." It is now more commonly called blackfellows' bread, in order to indicate its use by the Australian aborigines. It has sometimes been called in question whether the natives ever really used it as food, and I have endeavoured to get information on the subject from direct sources. The Rev. F. A. Hagenauer, General Inspector of Aborigines, writes to me as follows:—"I know the fungus well, and have often seen the old blackfellows eat the same, when they called it "garni banyip" or native bread. It used to be dug out of the ground on the banks of the Wimmera river, near Lake Hindmarsh, and good quantities were found in the Western District, near Lake Condah." The Rev. J. H. Stähle in charge of the Aboriginal Mission Station, Lake Condah, kindly made inquiries for me from some of the oldest blacks living there, and he replied as follows:—"The natives inform me: 1st. That they have never seen any form of fructification from the surface of the native bread, neither did they know where to look for it by any particular signs of toadstool growth, &c. It grew in dry ground (not wet), and when they found it, it was by observing the ground raised up and cracking in one spot, owing to the native bread forcing itself upwards. 2nd. It was not found attached in any way to underground roots, decaying wood, &c. 3rd. It was *generally* used by the blacks for food, not only in seasons of scarcity, but whenever they found it. They did not cook it in any way, but just cut it with their flint knives, and then ate it as they found it, only rubbing off the earth which adhered to the outside of the bread. 4th. As already stated, the blacks do not know where to find it from surface indications, other than those I have already referred to."

The late Mr. A. P. Miller, chemist, Tasmania, in forwarding a very large specimen of native bread to the British Pharmaceutical Conference in 1884, wrote in a very similar strain to the above. "I can say little about the native bread, except that the aborigines of Tasmania were very fond of it, and considered it a delicacy. There is neither leaf, branch, root or stem shown above ground to indicate where it can be dug for successfully; but after rains the natives used to discover the spots by cracks of a peculiar nature on the surface, which indicated its locality."

Tastes proverbially differ, and I can only say that the aborginals must have had few appetising foods in their daily fare when they considered native bread a delicacy, or it may have been on account of its comparative scarcity that it was considered such.

Chemical Composition.

No complete chemical analysis has been made of it, as far as I am aware, but Mr. Maiden, Government Botanist of New South

Wales has tested it in various ways. He found that it contained 78·68 per cent. of water and ·77 per cent. of ash, which although small in quantity is rich in phosphates. Of course the amount of water will depend on the freshness of the specimen examined. He says it does not contain nitrogen in any form and it is practically unalterable in water or reagents. When cut into pieces and placed in liquids, no swelling takes place, and the cut edges lose none of their sharpness, nor does the substance soften. If boiled in a dilute alkaline solution, only a small proportion of pectic acid is dissolved and this is thrown down when the solution is rendered acid. Altogether its chemical composition is peculiar and well worthy of special investigation. Mr. Maiden sums up by stating:—"The native bread, therefore, contains a small proportion of pectous substances, and can be only of infinitesimal nutritive value. It is immaterial whether it is eaten raw or boiling, and cold or hot water is equally ineffective in acting upon it. I consider the native bread to consist mainly of a modification of cellulose, most probably fungin."

Fructification.

"By their fruits ye shall know them," is a principle of very general application in the vegetable kingdom, and it was only when some means of reproduction were discovered in the native bread that its true nature and its relationship with other forms of fungi were understood. Various guesses were made as to what it really was, and some of these have already been referred to. The question as to what grows out of the sclerotium was answered some time ago, and this leads me to state briefly how the mystery was solved. As early as 1885 Mr. H. T. Tisdall exhibited specimens from Gippsland before the Field Naturalists' Club of Victoria, from which arose a regular cap and stalk, like an ordinary mushroom or toadstool. But instead of having gills like the edible mushroom on which the spores are developed there were closely crowded tubes on the under surface of the cap containing the spores, and so it was known to be a *Polyporus*. Mr. Tisdall made a careful coloured drawing which still bears witness to the accuracy of his determination, but, as he himself confesses, he did not understand at the time that he had really solved the problem of the reproduction of *Mylitta*, but it was solved nevertheless. Then in 1892, Dr. Cooke, the eminent mycologist, announced in the *Gardener's Chronicle*, under the heading of "A Mystery Solved," the discovery of the fructification on a specimen of native bread sent to him from South Australia. In the *Victorian Naturalist* for January, 1893, Mrs. W. Martin reports having sent to Dr. Cooke for identification, a specimen of native bread with the fruiting form attached to it. He was the first, however, to give it its true scientific name, which not only serves to distinguish it from other forms, but reveals its true relationship—*Polyporus mylittae*. Early in the succeeding year, Professor Saccardo also described a specimen forwarded by Professor Spencer, from Western Port, Victoria, and named it similarly to Dr. Cooke. The only other record of the fructification is that of Mr. R.

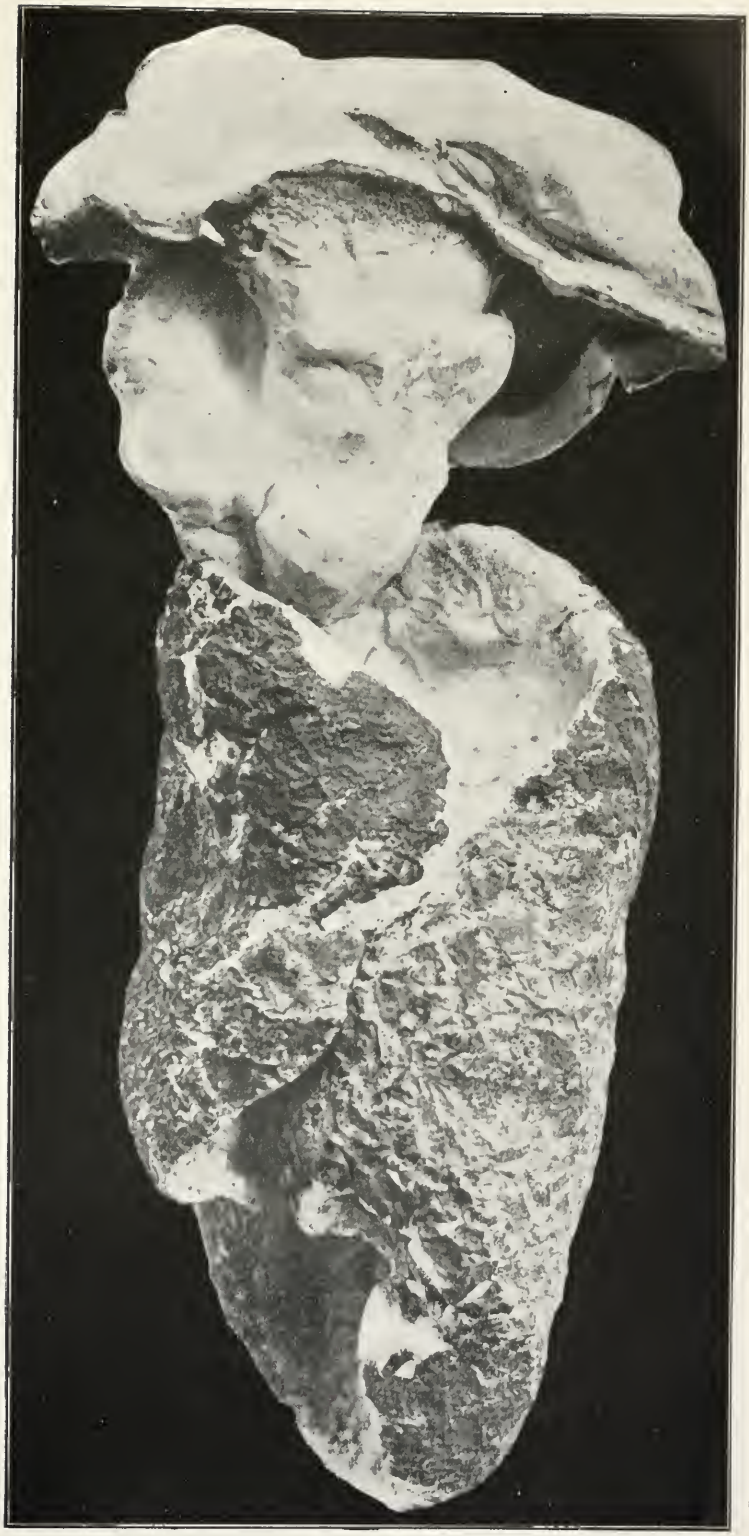

FIG. 3.—NATIVE BREAD WITH FRUCTIFICATION.—INNER VIEW.

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T. Baker in the Proceedings of the Linnæan Society of N.S.W. for 1902. From a good specimen of the bread, weighing 8 lbs., and cut in half, he succeeded in raising several of the forms, but although the cap measured over four inches in diameter and the pores were developed, no spores were found. It was my good fortune in November of last year to receive the specimen which is here reproduced (Figs. 2, 3) through Mr. Bastow, having been sent from Southport, Tasmania, by Mr. T. P. Cowle. It was cut up, wrapped in white paper and carefully laid aside to be kept as a natural history specimen, but in the course of five days the fructification burst through the paper, and in that condition it was brought under my notice, with a request to say what it was. There was no difficulty in recognising the *Polyporus*, and I saw at once that here we had another good example of the fructification of native bread. It arose from the inner or cut surface of the sclerotium, and was of a whitish or creamy white color. Alongside of this and originating in the same way, there was another smaller protuberance about $\frac{4}{5}$ in. in diameter, and somewhat oval, evidently a young fructification, which did not develop further.

The *Polyporus* is seen to be much mis-shapen, no doubt owing to the confined condition under which it was developed, and evidently consists of several caps merged together, and a smaller distinct pileus springing from the common stem a little lower down. The spores were produced in the tubes, and the fungus had fully developed. The compound nature of the whole structure is seen in the indications of the three stalks run together, and in the partially divided character of the pileus or cap.

The specimen just described had developed its fructification under rather unnatural conditions, and the blending of several into one was evidently due to the restrictions placed upon its free growth. So a thick slice was cut off from the native bread, and kept in the laboratory in a glass dish in which several layers of moist blotting paper were placed, in order that any further growth might be carefully watched, and that any fructification which might develop would be free to follow its natural tendencies.

The free surface at first became overgrown with a dense whitish to yellowish mould, and at one spot a slight swelling appeared which gradually increased in size, until at the end of a fortnight a well defined fungus was formed consisting of cap and stalk (Fig. 1). The stalk was rather short, stout, irregular on surface and only about half an inch high, and the cap or pileus, which was of a cream colour with a canary yellow tinge, was somewhat kidney shaped, having a slight indentation at one side. It was, however, roughly round and measured about three inches across, the tubes on the under surface being pure white. On the opposite side of the slice, which was lying flat upon the damp blotting paper, a quite unexpected formation occurred. The dense white mould overspread the surface as it did above, but since it was physically impossible to produce the usual stalk and cap, groups of tubes were formed, similar in size and

shape to those on the under surface of the cap. Here the fungus provided for the ordinary mode of reproduction by means of spores formed inside a tube, but it dispensed with the normal cap mounted on a stalk, which is certainly well adapted for spreading the spores. By placing ordinary microscopic glass slips smeared with glycerine under the cap the spores were collected in immense numbers and are shown in fig. 4, *d*, *e*, reproduced from photomicrographs by my assistant, Mr. G. H. Robinson, magnified by 500 and 1000 diameters respectively.

The dense white mould consisted of interlacing filaments long and branched, straight or wavy, but without partitions, and the walls were so much thickened as to leave only a narrow tube. The walls are very characteristic, being closely and beautifully striated.

Origin of the Sclerotium or Native Bread.

It has been shown how the fructification originates from the sclerotium and it would be desirable to trace the sclerotium from the spore but that has not been followed. By examining specimens, however, at various stages of growth, some idea may be gained as to how it arises.

The small nearly globular form about the size of a pea (Fig. 4*c*) was sent from Kardella in June and forwarded to me through the courtesy of Mr. French. It was ruddy brown in colour and near one end gave off a slender brown root-like portion from the somewhat flattened base. This flattened cord was about one and a half inch long and attached by the other end to the peeling off bark of a Eucalyptus root. It was firmly attached to the root and extended along the bark for a short distance. It consisted of a number of hyphal strands, yellowish in colour as seen by transmitted light.

In the absence of direct proof, but taking analogy for our guide, we may conceive the spore on germination to produce hyphae or fungus threads, which may either grow in the soil and absorb nutriment from decaying vegetable matter, or perhaps even attack the roots or underground portions of various plants and cause their decay. It is quite common to find abundance of white mycelium in the soil where the native bread occurs, binding the earth together in large masses and it is just possible that there may be some connection. At any rate the hyphae appearing on the cut surface of the bread can spread over and into adjacent soil as pointed out by Mr. Baker. Under certain conditions the hyphae originating from the spores may grow together in strands, forming a dark outer layer or skin and an inner whitish portion. These root-like strands are the so-called rhizomorphs, which are just in a sense slender and extended sclerotia, and in one of our commonest fungi, which causes root-rot, the honey agaric, these cord-like rhizomorphs produce a cap-fungus appearing above ground. But in the case of native bread these rhizomorphs expand at the end and grow out into the dense mass of fungus filaments constituting a sclerotium, as in Fig. 4*c*. These sclerotia very

G. H. Robinson, Photo.

FIG. 4

A. Elongated sclerotium, outside view; B. Section of elongated sclerotium × $\frac{2}{3}$;
C. Small sclerotium attached by rhizomorph to root of Eucalypt, nat. size;
D. Spores from Fig. 1 × 500; E. Spores × 1000.

probably take a number of years to attain their full size which will of necessity vary according to the amount of material available. Decaying wood found in the very heart of some of these sclerotia, as in the specimen shown in Fig. 4*a*, and the formation of sclerotia around decaying roots in the soil, suggest that in some cases at least, the hyphae may directly give rise to them, without the intervention of rhizomorphs, when there is plenty of nutritive material at hand.

I have just received numerous specimens of native bread, some of which may be seen in Fig. 5*b*, through the kindness of Mr. Nobelius, of Emerald, from which I hope to grow the fructification and produce the spores, so that when sown in soil taken from the spot where the native bread originally grew, they may germinate and allow their history to be traced. Balls of earth with hyphae running through them have also been secured, and they too will be watched for further development.

Technical Description.

The technical description of the fungus is now given, so that it will be possible to determine afterwards whether there are more than one species of native bread in Australia.

Polyporus mylittae, C. & M.

Pileus corky, firm, creamy white or yellowish white, generally round with indentations and margin upturned, flesh chalky white, solitary and about three inches across or several coalesced (at least three) and irregular, four inches across.

Stalk arising from a downy base, sub-central, solid, similarly coloured to pileus, round or deformed, $\frac{1}{2}$—$1\frac{1}{2}$ inches high.

Pores angular, white, adnate, comparatively shallow, variable in size, $\frac{1}{2}$—1 mm. across.

Spores hyaline, smooth elongated ellipsoid, slightly apiculate at base, 6—$6\frac{1}{2}$ × $2\frac{1}{2}$—3 microns.*

Arising from the sclerotium known as *Mylitta australis*, Berk. Victoria, New South Wales, Queensland, South Australia, Tasmania.

Dr. Cooke describes the pileus as single or 2 or 3 together, white, and about 4 inches in diameter, and the spores as elliptical with an oblique basal apiculus, smooth, 8 × 4 microns.

Professor Saccardo also describes the pileus as white or whitish, and over 6 inches in diameter, presumably solitary. The spores are given as globular, scarcely apiculate, hyaline, $4\frac{1}{2}$-5 microns in diameter.

Mr. Baker grew four distinct specimens on the two halves of the same sclerotium. The upper surface of the pileus was at first of an orange brown color in the centre, with a mauve band slightly removed from the edge, and resembling a poached egg in form and color when viewed from above. The diameters of the two largest were 3 and 4 inches respectively, and no spores were detected.

A micron is $\frac{1}{25000}$ of an inch.

In both my specimens abundance of spores were obtained, and as they were freely shed they may be regarded as mature. The nature of the soil in which the sclerotium occurs may have something to do with the color of the *Polyporus,* for in the specimens obtained from Tasmania the pileus was tinged a distinct canary-yellow.

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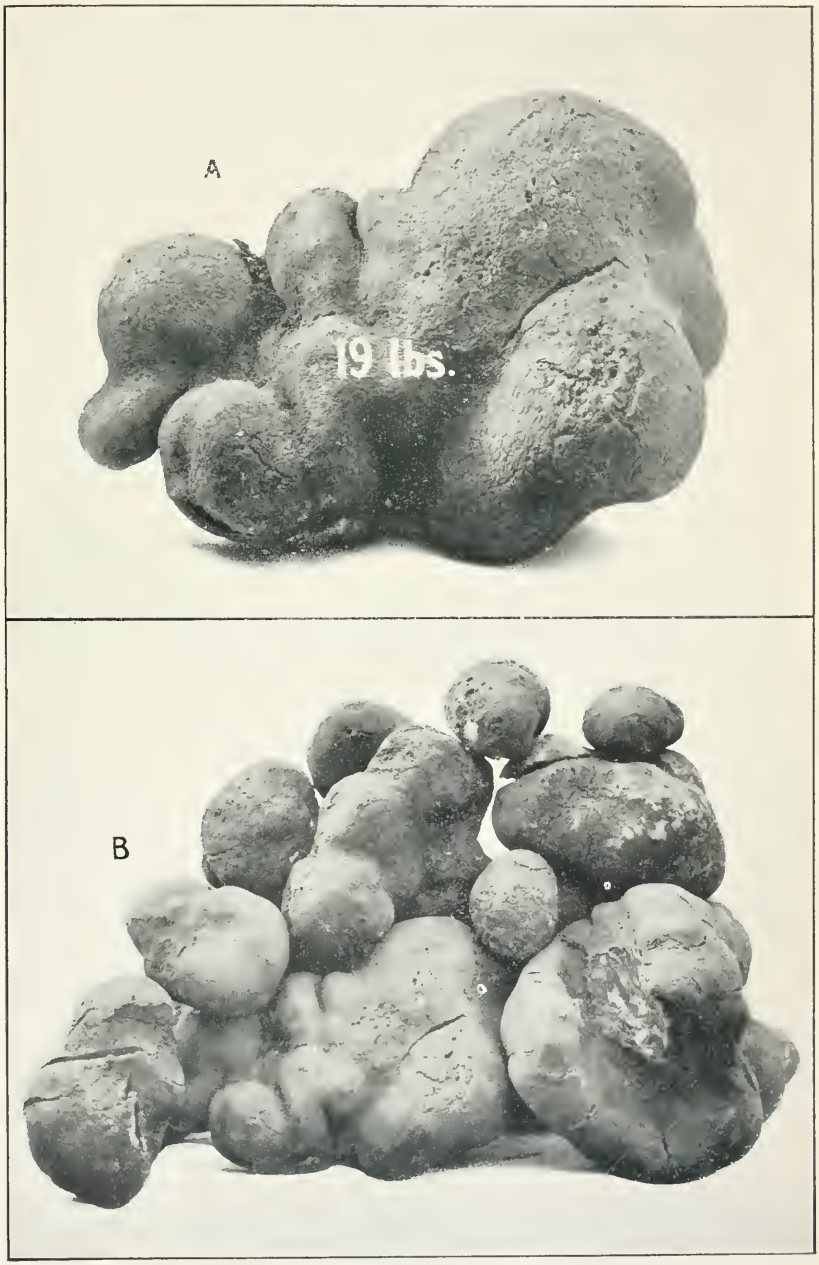

G. H. Robinson, Photo. FIG. 5

A. Sclerotium from Emerald weighing 19 lbs B. Group of Sclerotia from Emerald.

GENERAL NOTES.

Formalin for Smut.

CONFESSIONS OF AN AMERICAN DRUGGIST.

Professor Ladd of the North Dakota Experiment Station, U.S.A., has been inquiring into the complaints made by some farmers that the formalin treatment for smut proved ineffective in their hands. The following extract from Bulletin 60 issued by that Station will be read with interest in connection with the revelations recently made by Dr. Howell, regarding the quality of formalin sold locally. To make the subject clear, it should be stated that formalin is a trade name for a 40 per cent. solution of formaldehyde in water.

"In our efforts to get at the true inwardness of the trouble one prominent druggist gave us the following statement which may help to throw some light upon this mooted question.

'Many of the druggists of the state are dispensing a so-called pound of formaldehyde in a Best tonic bottle and two pounds in a beer bottle. In other words less than 16 fluid ounces is sold as a pound, while as a matter of fact a pound by weight occupies more than 16 fluid ounces space. The result is plain. From the druggists' standpoint it means the discrediting of formaldehyde as a smut killer and a consequent falling off in sales. From the farmers' standpoint they suffer in at least three ways by this short measure.

1st. They pay for a pound and get 10 ounces.

2nd. They use 10 ounces, believing it to be a pound and get a solution of so weak a germicidial strength as to be nearly worthless and lose their labor in applying it.

3rd. Much the most important of all they lose in smut laden crops where they have paid their money and expended their energies, believing that they have complied with all conditions necessary to 'give formaldehyde a chance' and be rid of smut.

Their natural and legitimate conclusions are that formaldehyde is no good. They have used it according to directions, they think, and failed to get results. From the papers and also from a circular received from you a few days ago I see you blame this failure to get results to under strength formaldehyde. Your conclusions are partly right, but I thought you ought to know the short weight fact (maybe you do) 12 ounces or three-fourths measure of 40 per cent. means only practically the same as 30 per cent. full measure, and I don't believe the farmers add enough of these light weight 'pounds' to make a solution of the desired strength to kill smut.

Now I suggest that a circular be sent out to all the pharmacists of the state, telling them that an effort will be made to secure these light weight packages, and if found the dispenser will be exposed unless he can prove that he has issued them in error.

Now, Professor, I expect you to accept this information in strictest confidence. Use your own judgment as to whether you act at all, or if so, what way. I request that no rumpus be made but that all be first given a chance to get into line. Then make it disagreeable for the crooks if you like.

I am not giving this information for any other reason than to make and keep formaldehyde popular as an efficient smut killer.'

It is quite clear that manufacturers and druggists alike are responsible to a considerable extent for the discrediting of the formaldehyde method for destroying smut. I can see but one remedy and that lies in enacting a law which shall be strictly enforced, regulating the sale of formaldehyde. A law similar to the fertilizer law, well enforced, would put a stop to the present practices and ensure fair treatment for the farmer, who is made to suffer heavy loss and the state loses many thousands of dollars each year by smutted wheat, which is entirely unnecessary since the farmers are doing their best to prevent this disease."

Treatment of Phylloxerated Vines with Lysol.

Some time since, at the request of the Mildura Horticultural Society the Department communicated with Prof. Serouilla, Principal of the Montpellier College of Agriculture in France, asking for such information as was available in reference to the treatment of phylloxerated vines by lysol. In reply, Prof. Serouilla stated "that the experiments undertaken at the Agricultural College at Montpellier, have always given negative results, and lysol has in all cases proved to be ineffective against the cryptogamic (fungus) diseases to which vines are subject."

Tanning Skins.

Mr. D. McKenzie of the Public Works Department furnishes the accompanying method of tanning, which has proved entirely successful in his hands :—

Pour two quarts of boiling water over one quart of bran, and in two quarts of warm water at blood heat dissolve as much salt as it will take up, about ¼ lb.; then mix the saltwater and the branwater together, making one gallon, to which add one ounce of sulphuric acid. Soak the skins in this mixture, using an earthenware vessel, well stirring the while, for 20 to 25 minutes, then rinse in cold water and hang to dry in a shady place. In drying, pull skins well and remove any fat and they will become perfectly white.

Utilising by-products of the Vineyard.

Mr. Thos. Blayney of the Goulburn Valley Vineyard writes :— "It may not be generally known, even to vignerons, that vine-cuttings are useful as fodder for cattle and horses in dry bare winters. If certain varieties of vine-cuttings are thrown over the fence into a

paddock where horses and cattle depasture, it will be seen that they will munch away at the cuttings for hours at a time until scarcely a vestige of the cuttings is left. I have no idea of the amount of nutriment contained in vine cuttings, but the very fact of stock being fond of them proves that they are a valuable adjunct to other available feed when it is not too plentiful. Sappy pithy vines such as the Pineau Blanc, and Hermitage are devoured greedily whereas the harder wooded vines, Carbinet and Reisling for instance, are left till the last or scarcely touched, unless the stock are very hungry. The prunings should be thrown out to the stock every evening immediately after being pruned, in armfuls well apart, and if this is done regularly through the pruning season the stock will be found waiting for their evening repast and they will be there first thing in the morning if there are any cuttings left. I see by the May issue of the *Journal* that Mr. Burney translated an article from the *Revue de Viticulture* recommending the crushing of vine-cuttings before feeding them to stock, and I understand that in France they are cut up in the same way as we cut chaff. Doubtless, these methods make a more attractive feed, but I think the simpler method of tossing out cuttings as they come from the pruner, without going to any trouble or expense whatever, will commend itself to Australian vignerons.

Vine leaves where they can be spared, and vines cut down to within one or two leaves of the grapes, will keep stock alive and strong during a bad summer. I saved the lives of 70 head of two year olds during a severe drought by feeding them in this manner.

The grape seed is good for fowls. For many years I have had the pressings carted out from the cellar and spread out within reach of the poultry and they scarcely cease feeding on the grape seeds all the year round. The grape seed is all the more valuable, inasmuch as it will remain perfectly sound for years exposed to the weather, and will not germinate once in every ten years, even when ploughed in. It is thus a continuous food supply for poultry without giving any trouble whatever."

A new volume commences in January and an Index to the present volume will be supplied with that number.

RAINFALL IN VICTORIA.

MONTHS OF AUGUST AND SEPTEMBER, 1904.

By P. Baracchi.

Areas.	Actual Average rainfall recorded in each Area in Aug., 1904.	Average rainfall for each Area for the month of Aug. based on all previous years of record.	Maximum fall recorded within each Area during Aug., 1904.	Actual Average rainfall recorded in each Area in Sept., 1904.	Average rainfall for each Area for the month of Sept. based on all previous years of record.	Maximum fall recorded within each Area during Sept., 1904.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
A	0·63	1·59	0·81 at Berriwillock	0·39	0·94	0·65 at Mildura
B	1·65	2·19	1·89 ,, Nhill	0·79	1·72	1·68 ,, Apsley
C	2·63	3·25	3·52 ,, Panmure	2·09	2·86	2·85 ,, Terang
D	3·15	4·01	4·21 ,, PortCampbell	2·53	3·71	3·34 ,, Port Campbell
E	1·33	1·55	1·97 ,, Echuca	0·52	1·23	0·90 ,, Charlton
F	2·41	2·46	3·39 ,, Eldorado	0·71	2·06	1·05 ,, Benalla & Wang'ratta
F1	2·30	3·00	2·44 ,, Nagambie	0·96	2·35	1·36 ,, Yea
F2	4·27	3·77	5·83 ,, Beechworth	1·33	3·67	1·81 ,, Beechworth
G	1·97	2·52	2·92 ,, Kyneton	1·01	2·10	1·58 ,, Kyneton
H	3·52	3·19	3·75 ,, Daylesford	1·40	3·05	1·69 ,, Daylesford
I	2·32	2·29	3·28 ,, Melbourne	1·11	2·55	1·49 ,, Ballan
I1	3·47	2·98	4·73 ,, Lilydale	2·53	3·25	4·03 ,, Grantville
K	3·51	4·77	6·47 ,, Warburton	3·36	4·72	5·47 ,, Foster
L	1·53	2·40	2·05 ,, Traralgon	2·83	2·89	3.87 ,, Traralgon
M	—	2·72	4·62 ,, Gabo	—	3·08	3·24 ,, Gabo

SUBDIVISIONAL AREAS OF THE STATE OF VICTORIA REPRESENTING TYPICAL DISTRIBUTION OF RAINFALL.

A. North-west—Mallee country, including the counties of Millewa, Taila, Weeah, and Karkarooc.

B. Central West—Including the counties of Lowan and Borung.

C. Western Districts—Including the counties of Follett, Dundas, western half of Ripon and Hampden.

D. South-western Districts and West Coast—Including the counties of Normanby, Villiers, Heytesbury, and Polwarth.

E. Northern Country—Including the counties of Tatchera and Gunbower, and the northern half of Kara Kara, Gladstone, and Bendigo, and the north-west portions of Rodney and Moira.

F. Northern Country—Including the greater part of the county of Moira, the north-eastern quarter of the county of Rodney, and the extreme north-west of the county of Bogong.

F1. Central North—Including the county of Anglesey, the west and northern parts of the county of Delatite, the extreme south of the county of Moira, and the south-east quarter of Rodney.

F2. Upper Murray—Districts from Wodonga to Towong.

G. Central Districts North of Dividing Ranges—Including counties of Talbot and Dalhousie, southern half of the counties of Kara Kara, Gladstone, and Bendigo, and the south-west quarter of the county of Rodney.

H. Central Highlands and Ranges from Ararat to Kilmore.

I. South Central Districts on the west and north side of Port Phillip Bay—Including the counties of Grant, Grenville, and Bourke, and the eastern parts of the counties of Hampden and Ripon.

I1. South Central Districts east of Port Phillip Bay, &c.—Including the counties of Mornington and Evelyn.

K. Regions of Heaviest Rainfall—Including all the mountainous Eastern Districts, and South Gippsland.

L. South-eastern Districts—Gippsland, and counties on the New South Wales Border.

M. Extreme East Coast.

STATISTICS.

Perishable and Frozen Produce.

EXPORTS DURING THE MONTHS OF SEPTEMBER 1904 AND 1903 RESPECTIVELY.

Description of Produce.		SEPTEMBER.	
		1904.	1903.
Butter	lbs.	2,052,508	1,512,356
Milk and Cream	cases	640	1,058
Cheese	lbs.	71,520	43,320
Ham and Bacon	,,	103,920	79,600
Poultry	head	5,535	9,525
Eggs	doz.	3,720	—
Rabbits and Hares ..	pairs	530,244	237,586
Mutton and Lamb ..	carcases	6,135	20,995
Beef	quarters	66	4,026
Veal	carcases	2,041	1,305
Pork	,,	78	62
Fruit	cases	3,750	2,259
Fruit Pulp	,,	1,970	5,495

DELIVERIES FROM THE GOVERNMENT COOL STORES FOR THE MONTHS OF SEPTEMBER 1904 AND 1903 RESPECTIVELY.

Description of Produce.		SEPTEMBER.	
		1904.	1903.
Butter..	lbs.	1,634,864	793,912
Milk and Cream	cases	729	778
Cheese	lbs.	12,317	—
Poultry	head	612	105
Eggs	dozen	950	—
Rabbits and Hares ..	pairs	117,716	79,488
Mutton and Lamb ..	carcases	4,358	7,305
Beef	quarters	6	257
Veal	carcases	1	250
Pork	,,	55	—
Fruit	cases	30	60
Sundries	lbs.	6,647	7,710

ARRIVALS IN MELBOURNE OF BUTTER and Butter ex Cream in Tons net, from the different districts of the State for the last 13 months, as compared with the previous corresponding months.

Months.	Total.		North-Eastern.		Northern.		Gippsland.		Western and S. Western.	
	1903	1902	1903	1902	1903	1902	1903	1902	1903	1902
September	1288	1042	323½	215	67½	63	317	267	560	496
October	2125	1607	439	360	174	92	697	567	812	788
November	2750	2049	622	430	201	94	843	787	984	738
December	2756	1995	528	358	194	83	1026	860	1008	694
	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.	1904.	1903.
January	2220	1885	403	362	150	66	917	870½	750	686½
February	2047	1383½	407	90½	170	51½	844	814	626	427½
March	2033	1371	316	112	156	27	938	740¾	623	491½
April	1167	910½	155	140	77	14½	580	443	354	313
May	930	794	119	137	29	14	460	354	315	209
June	596	595½	105½	116	29	13½	239	213	222	251
July	527½	563½	111	108	53	16½	134½	179	229	260
August	1063½	641	300	163	152½	33	170½	122	440½	323
September	1894½	1286	509	323½	272	67½	427½	217	386	360

R. CROWE.

Fruit and Plants.

EXPORTS to Australian States and New Zealand only, Inspected during August and September, 1904.

Fruit.	Cases or Packages Inspected.		Certificates Given.	
	August.	September.	August.	September.
Apples	79	65	26	21
Bananas	320	579	101	101
Cucumbers	—	14	—	6
Lemons	570	468	66	85
Melons	1	—	1	—
Mixed Fruits	—	11	—	1
Oranges	975	1,282	97	105
Passion Fruit	22	73	20	44
Pineapples	129	212	56	62
Tomatoes	20	48	8	22
Total Cases, Fruit	2,116	2,752	375	447
Plants, Packages	22	22	15	14
Totals	2,138	2,774	390	461

J. G. TURNER, Inspector,
For C. French.

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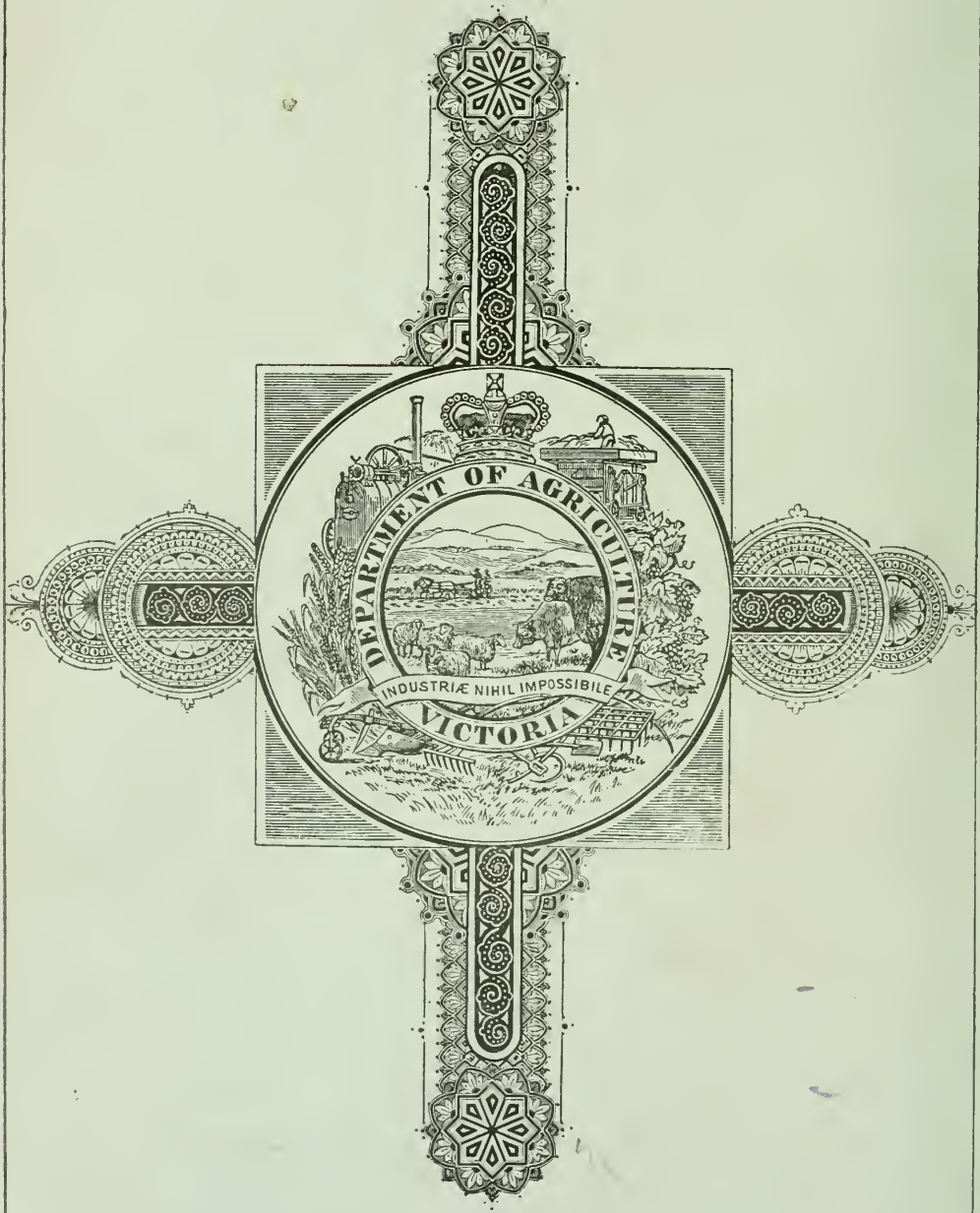
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